

8701 Section Titled: Mississippi Curriculum Framework, Culinary Arts REPEAL

~~FRAMEWORKS FOR
VOCATIONAL-TECHNICAL PROGRAMS
REVISED IN
2011~~

~~SECONDARY
EXECUTIVE SUMMARY
2011~~

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Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task—An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
 - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
 - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies—This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies—This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.
- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards—This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the 21st-Century

Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. The need for these types of skills have been recognized for some time and the 21st Century Skills are adapted in part from the 1991 report from the U.S. Secretary of Labor's Commission on Achieving Necessary Skills (SCANS). Another important aspect of learning and working in the 21st century involves technology skills, and the International Society for Technology in Education, developers of the National Education Technology Standards (NETS), were strategic partners in the Partnership for 21st Century Skills.

- ~~References~~—A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

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Culinary Arts Executive Summary

Program Description

Culinary Arts is a pathway for students in the Human Science, Art, and Humanities career cluster. The following description is from the current Standard Course of Study, for Career-Technical Education, Mississippi Department of Education.

The Culinary Arts pathway program includes classroom and hands-on experiences that will prepare students for employment or continuing education in the foodservice industry. This program was written to incorporate the **National Restaurant Associations (NRA) ProStart** learning objectives. Any student who successfully completes this program and the mentoring requirements of the NRA can take the National ProStart Certificate of Achievement exam. This is a national certification program recognized throughout the foodservice industry. Each district should implement a maximum student number due to the size of each lab.

Industry Certification

This program was designed to articulate to postsecondary Food Production, Hotel and Restaurant Management, and Culinary Arts. Industry standards are based on the *National Restaurant Association ProStart Certification and the National Restaurant Association ServSafe Certification*.

Assessment

Students will be assessed using the Culinary Arts MS-CPAS2 test. The MS-CPAS2 blueprint can be found at <http://redesign.reu.msstate.edu/curriculum/>. If there are questions regarding assessment of this program, please contact the Culinary Arts instructional design specialists at the Research and Curriculum Unit at 662.325.2510.

Student Prerequisites

In order for students to be able to experience success in the Culinary Arts program, the following student prerequisites are in place:

1. C or higher in English (the previous year)
2. C or higher in Math (last course taken or the instructor can specify the math)

OR

3. Instructor Approval and TABE Reading Score (eighth grade or higher)

OR

4. Instructor Approval

~~Proposed Applied Academic Credit~~

~~The mathematics content in the Culinary Arts program is meaningful and useful to students who are entering the foodservice industry. Applied mathematics content was aligned to the 2007 Mississippi Mathematics Framework Revised Academic Benchmarks. It is proposed that upon the completion of this program, students will earn ½ applied mathematical credit that can be used for graduation requirements.~~

~~The applied academic credit has *not* been approved by the MS Commission on School Accreditation or by the State Board of Education. If there are questions regarding applied academic credit, please contact the Coordinator of Workforce Education at the Research and Curriculum Unit at 662.325.2510.~~

~~Licensure Requirements~~

~~Mississippi teacher license endorsement 972 is needed to teach the Culinary Arts pathway. Requirements for the 972 educator endorsement are listed below:~~

- ~~1. Applicant must have earned an AA degree or higher.~~
- ~~2. Applicant must enroll immediately in the Vocational Instructor Preparation (VIP) or the Redesign Education Program (REP).~~
- ~~3. Applicant must complete the individualized Professional Development Plan (PDP) requirements of the VIP or REP prior to the expiration date of the 3-year vocational license.~~
- ~~4. Applicant must complete all components of the national Prostart Certification program.~~
- ~~5. Applicant must successfully complete the ServSafe certification exam (updated every 5 years).~~
- ~~6. Applicant must successfully complete an approved computer literacy certification exam.~~
- ~~7. Applicant must successfully complete a certification for an online learning workshop, module, or course that is approved by the Mississippi Department of Education.~~
- ~~8. Applicant must successfully complete a Culinary Arts certification workshop, module, or course that is approved by the Mississippi Department of Education.~~

~~Professional Learning~~

~~The professional learning itinerary for the middle school or individual pathways can be found at <http://redesign.reu.msstate.edu>. If you have specific questions about the content of each training session provided, please contact the Research and Curriculum Unit at 662.325.2510, and ask for the Professional Learning Specialist.~~

Course Outlines

~~This curriculum provides options for local school districts to meet student needs and scheduling demands. The first option groups units into four 1-Carnegie unit courses. The second option groups units into two 2-Carnegie courses. Please see below for a description of each option.~~

Option 1

~~This option consists of four 1-credit courses that should be completed in the following sequence:~~

- ~~1. Orientation to Culinary Arts (Course Code: 996002)~~
- ~~2. Theory and Applications of Culinary Arts, Part A (Course Code: 996004)~~
- ~~3. Theory and Applications of Culinary Arts, Part B (Course Code: 96005)~~
- ~~4. Advanced Studies in Culinary Arts (Course Code: 996006)~~

~~**Course Description:** Orientation to Culinary Arts includes the foundation skills necessary in the foodservice industry. Content such as food safety and sanitation, equipment, safety and security, culinary foundations and math, and an introduction to the hospitality industry are included in the course. Mastery of the competencies listed in the food safety and sanitation unit will prepare the student to take the NRA's ServSafe exam to become ServSafe Food Safety certified. As of January 1, 1999, every foodservice establishment in Mississippi must have a full-time certified food manager employed in order to meet the FDA Food Code requirements. Students are encouraged to take this exam.~~

~~**Course Description:** Theory and Applications of Culinary Arts, Part A emphasizes real-world, hands-on practice of food preparation. Food preparation techniques included in this course include breakfast foods, dairy, and sandwiches; fruits, vegetables, salads, and garnishes; and potatoes and grains. This one-Carnegie unit course should only be taken after students successfully pass Orientation to Culinary Arts (Course Code: 995002).~~

~~**Course Description:** Theory and Applications of Culinary Arts, Part B emphasizes real-world, hands-on practice of food preparation. Food preparation techniques included in this course include desserts and baked goods; meat, poultry, and seafood; and stocks, sauces, and soups. This one-Carnegie unit course should only be taken after students successfully pass Theory and Applications of Culinary Arts (Course Code: 995004).~~

Course Description: ~~Advanced Studies in Culinary Arts is a culminating course that places emphasis on an internship experience. While they participate in the on-the-job training, the students will use their skills that are related to management and business concepts, customer communication, and customer service. Before students can complete the Advanced Placement Culinary Arts course, they must meet the following requirements:~~

~~Score 80% or higher on the MS-CPAS2 summative assessment.~~

~~Attendance rate of 92% or better in the Orientation to Culinary Arts (Course Code: 996002) and the Theory and Applications of Culinary Arts parts A and B (Course Code: 996004 and 996005)~~

~~Find a job related to the culinary industry.~~

Orientation to Culinary Arts (One Carnegie Unit) -- Course Code: 996002

Unit	Title	Hours
1	Introduction	10
2	Human Relations Management	25
3	Food Safety and Sanitation	30
4	Foodservice Equipment, Safety, and Security	30
5	Culinary Foundations	35
		130

Theory and Applications of Culinary Arts, Part A (One Carnegie Unit) -- Course Code: 996004

Unit	Title	Hours
6	Breakfast Foods, Dairy, and Sandwiches	25
7	Fruits, Vegetables, Salads, and Garnishes	35
8	Culinary Math	25
		85

~~Theory and Applications of Culinary Arts, Part B (One Carnegie Unit) – Course Code: 996005~~

Unit	Title	Hours
9	Orientation	20
10	Hospitality Industry	30
11	Potatoes and Grains	25
12	Customer Communication and Service	25
13	Desserts and Baked Goods	25
		125

~~Advanced Studies in Culinary Arts (One Carnegie Unit) – Course Code: 996006~~

Unit	Title	Hours
14	Culinary Business Concepts	45
15	Meat, Poultry, and Seafood	25
16	Stocks, Sauces, and Soups	25
		95

~~Option 2~~

~~This option consists of two 2-Carnegie unit courses that should be completed in the following sequence:~~

- ~~1. Culinary Arts I (Course Code: 996000)~~
- ~~2. Culinary Arts II (Course Code: 996001)~~

~~Course Description:~~ ~~Culinary Arts I is the first course of the program. Food preparation techniques included in this course are breakfast foods, dairy, sandwiches, salads, garnishes, fruits, and vegetables. Management skills emphasized are basic customer service, food safety and sanitation, workplace safety and security, culinary basics, equipment, nutrition, human resources, math, and food cost control. Mastery of the competencies listed in the food safety and sanitation unit will prepare students to take the NRA's ServSafe exam to become ServSafe Food~~

Safety certified. As of January 1, 1999, every foodservice establishment in Mississippi must have a full-time certified food manager employed in order to meet the FDA Food Code requirements. Students are encouraged to take this exam.

Course Description: Culinary Arts II is a continuation of the emphasis on management and food preparation. Management topics include marketing, accounting, purchasing, inventory, and advanced customer service. Food preparation techniques covered include potatoes, grains, desserts, baked goods, meat, poultry, seafood, stocks, sauces, and soups. An exploration of culinary history is also included in this course. The course should be taken after the student has successfully passed Culinary Arts I.

Culinary Arts I (Course Code: 996000)

Unit	Title	Hours
1	Introduction	10
2	Human Relations Management	25
3	Food Safety and Sanitation	30
4	Foodservice Equipment, Safety, and Security	30
5	Culinary Foundations	35
6	Breakfast Foods, Dairy, and Sandwiches	25
7	Fruits, Vegetables, Salads, and Garnishes	35
8	Culinary Math	25
		215

Culinary Arts II (Course Code: 996001)

Unit	Title	Hours
9	Orientation	20
10	Hospitality Industry	30
11	Potatoes and Grains	25
12	Customer Communication and Service	25
13	Desserts and Baked Goods	25
14	Culinary Business Concepts	45
15	Meat, Poultry, and Seafood	25
16	Stocks, Sauces, and Soups	25
		220

Culinary Arts Competencies and Objectives

Unit 1: Introduction

1. ~~Identify school and program policies and procedures, and compare/contrast them with industry policies and procedures. (DOK 1)~~
 - a. ~~Discuss the school handbook and all safety procedures for classroom and building levels.~~
 - b. ~~Review program policies in the classroom, laboratory, and industry.~~
2. ~~Identify career and leadership opportunities in the culinary industry. (DOK 1)~~
 - a. ~~Investigate career opportunities in the culinary industry to include communication writers, food stylists, marketers, research and development, food science, sales, dietitians, food production, food processing, accounting, entrepreneurs, trainers, and grocery store and deli managers.~~
 - b. ~~Investigate the occupational outlook and salaries for culinary careers according to current and future trends.~~
 - c. ~~Discuss the difference between school and workplace environments.~~
 - d. ~~Explore leadership opportunities available from student youth and industry organizations.~~
3. ~~Analyze the importance of service to the culinary industry. (DOK 2)~~
 - a. ~~Explore the elements of excellent service to include anticipating the customers' needs.~~
 - b. ~~Explore the elements of excellent service from the standpoint of the customer.~~
 - c. ~~Investigate the importance of positive attitudes and work ethics.~~
 - d. ~~Illustrate the qualities of successful foodservice employees.~~
 - e. ~~Develop a list of workplace guidelines to include attendance, teamwork, promptness, dependability, questions, fairness, honesty, and a positive attitude.~~
4. ~~Formulate a plan for an effective job search. (DOK 4)~~
 - a. ~~Create a generic cover letter.~~
 - b. ~~Identify a network of people that can provide information about job opportunities.~~
 - c. ~~Create a high-quality one-page resume.~~
 - d. ~~Complete a college and job application form.~~
 - e. ~~Construct an electronic portfolio.~~
 - f. ~~Participate in a mock effective job interview.~~
 - g. ~~Write a generic letter of resignation.~~

Unit 2: Human Relations Management

1. ~~Determine the skills necessary to provide professional customer service. (DOK 3)~~
 - a. ~~State the importance of customer service.~~
 - b. ~~List the reasons and the ways to make a positive first impression.~~
 - c. ~~Describe a variety of customers that may have special needs.~~

- d. ~~Distinguish between effective and ineffective communication with customers by giving examples.~~
- e. ~~Explain how customer satisfaction directly affects a restaurant's success.~~
- f. ~~Create job standards for servers.~~
- 2. ~~Demonstrate excellent interpersonal skills. (DOK 2)~~
 - a. ~~Exhibit a positive attitude.~~
 - b. ~~Practice teamwork.~~
 - c. ~~Demonstrate effective verbal and nonverbal communication skills.~~
 - d. ~~Apply conflict resolution skills to real-life situations.~~
- 3. ~~Analyze supervisory skills related to human resource management. (DOK 4)~~
 - a. ~~Explain how stereotypes and prejudices can negatively affect how people work together.~~
 - b. ~~List and demonstrate effective legal interviewing skills.~~
 - c. ~~Discuss the importance of having new employee orientation.~~
 - d. ~~Describe common elements of orientation programs.~~
 - e. ~~Analyze the most effective training technique for different purposes to include on-the-job training, role playing, and/or group training.~~
 - f. ~~List and apply effective techniques used in performance evaluations.~~

Unit 3: Food Safety and Sanitation

- 1. ~~Discuss and relate the importance of food safety to society. (DOK 2)~~
 - a. ~~List reasons why it is important to keep food safe.~~
 - b. ~~Describe good personal hygiene and how it affects food safety.~~
 - c. ~~List the steps to proper hand washing.~~
 - d. ~~Give examples of potentially hazardous foods.~~
 - e. ~~Categorize and describe the microorganisms that cause foodborne illness.~~
 - f. ~~Identify and list ways biological, chemical, and physical hazards can contaminate food.~~
 - g. ~~Identify the eight most common allergens, associated symptoms, and methods of prevention.~~
 - h. ~~Distinguish between situations in which contamination and cross-contamination can occur.~~
 - i. ~~List the conditions under which bacteria can multiply rapidly, and use the letters FAT-TOM.~~
 - j. ~~Explain how time and temperature guidelines can reduce the growth of microorganisms.~~
 - k. ~~Define the food temperature danger zone, and list temperatures that fall within that zone.~~
 - l. ~~Differentiate between different types of thermometers, and demonstrate how to use them.~~

2. Explain the importance of establishing a food safety system. (DOK 1)
 - a. List the seven major steps in a Hazard Analysis Critical Control Points (HACCP) system and the four steps to Active Managerial Control focusing on controlling the CDC's five most common risk factors.
 - b. Analyze a recipe, and rewrite it to meet HACCP guidelines.
3. Analyze the flow of food through a foodservice establishment. (DOK 4)
 - a. Compare different types of storage areas found in a foodservice operation.
 - b. Outline proper procedures for receiving, storing, preparing, cooking, holding, cooling, reheating, and serving food that includes use of proper tools and equipment.
4. Maintain a clean and sanitary kitchen. (DOK 1)
 - a. Define the difference between clean and sanitary.
 - b. Demonstrate procedures for cleaning and sanitizing tools and equipment.

Unit 4: Foodservice Equipment, Safety, and Security

1. Implement safe work habits to prevent injuries (ongoing). (DOK 2)
 - a. Discuss OSHA (Occupational Safety and Health Administration) and why it is important.
 - b. Describe the Hazard Communication Standard requirements for employers.
 - c. Identify the location and purpose of Material Safety Data Sheets.
 - d. Identify electrical hazards that contribute to accidental fires and shocks.
 - e. Classify different types of fires and fire extinguishers to include automatic sprinklers and hood systems.
 - f. Describe the ways to prevent both fire and chemical burns.
 - g. List hazards that contribute to injury due to slips, trips, or falls.
 - h. Outline proper procedures for cleaning spills on floors.
 - i. Demonstrate the proper use of ladders.
 - j. Demonstrate proper lifting and carrying procedures to avoid injury.
 - k. Demonstrate correct and safe use of knives including handling, walking, passing, washing, and storing.
 - l. Identify other hazards that can cause cuts.
 - m. List ways to use protective clothing and equipment to prevent injuries.
2. Explain emergency techniques and procedures. (DOK 1)
 - a. Outline proper actions to take in the event of a fire.
 - b. Describe basic first aid concepts and procedures for choking, cuts, burns, falls, strains, electrical shocks, and heart attacks.
 - c. Explain the importance of completing standard reports for accidents or illnesses.
 - d. Describe procedures to manage robberies, natural disasters, food security, and vandalism.
3. Analyze the correct use of hand tools. (DOK 3)
 - a. Identify basic kitchen hand tools.
 - b. Demonstrate proper cleaning, sanitizing, and maintenance of hand tools.
 - c. Demonstrate measuring and portioning hand tools.
 - d. Identify, use, and analyze the appropriate types and sizes of pots and pans.

4. ~~Develop standard operating procedures, and demonstrate the safe use and maintenance of large equipment. (DOK 2)~~
 - a. ~~Demonstrate how to cut and mix foods using standard kitchen equipment.~~
 - b. ~~Compare and contrast cooking foods using various types of steamers, broilers, grills, ranges, fryers, and ovens.~~
 - c. ~~Outline how to hold and serve food and beverages using equipment.~~
 - d. ~~Demonstrate proper assembly, dismantling, cleaning, sanitizing, and maintenance of foodservice equipment.~~

Unit 5: Culinary Foundations

1. ~~Develop and demonstrate basic food preparation skills. (DOK 2)~~
 - a. ~~Identify the components and functions of a standardized recipe.~~
 - b. ~~Recognize abbreviations.~~
 - c. ~~Weigh and measure ingredients with measuring devices by weight and volume.~~
 - d. ~~List the common equivalents of weights and measures.~~
 - e. ~~Convert a standardized recipe to increase and decrease yield.~~
 - f. ~~Use correct terminology for basic food preparation techniques.~~
 - g. ~~Apply mise en place through practice.~~
 - h. ~~Discuss different types of knives, and demonstrate basic cuts.~~
 - i. ~~Use common spices and herbs appropriately.~~
 - j. ~~Follow a standard recipe to produce a standard product.~~
2. ~~Develop and demonstrate basic food cooking methods. (DOK 2)~~
 - a. ~~Demonstrate the dry heat cooking methods.~~
 - b. ~~Demonstrate the moist heat cooking methods.~~
 - c. ~~Demonstrate the combination cooking methods.~~
3. ~~Discuss the components of a healthy diet. (DOK 1)~~
 - a. ~~Describe a healthy diet.~~
 - b. ~~Identify and discuss the role of nutrients to include carbohydrates, hormones, fiber, starch, and fat.~~
 - c. ~~Define and discuss cholesterol, and list the food in which it is found.~~
 - d. ~~Discuss the role of protein, water, vitamins, and minerals in a diet, and identify foods that contain these nutrients.~~
 - e. ~~Differentiate between complete and incomplete proteins.~~
 - f. ~~Interpret information on a food label.~~
 - g. ~~Identify and describe the Recommended Dietary Allowances (RDAs) and the Food Guide Pyramid.~~
 - h. ~~Determine the role of supplements in the diet.~~
4. ~~Design and produce a well-balanced meal. (DOK 4)~~
 - a. ~~Use the Recommended Dietary Allowances and the Food Guide Pyramid to plan and produce a meal.~~
 - b. ~~Apply nutritional concepts to various ways of making recipes more healthful to include sodium and fat reduction, increased fiber intake, and more nutrients.~~

Unit 6: Breakfast Foods, Dairy, and Sandwiches

1. ~~Create and evaluate breakfast foods. (DOK 3)~~
 - a. ~~Prepare and critique basic breakfast food items.~~
 - b. ~~Prepare and critique breakfast beverages.~~
2. ~~Demonstrate preparation and handling of dairy products. (DOK 2)~~
 - a. ~~Explain how to keep dairy products safe and sanitary.~~
 - b. ~~Differentiate between butter and margarine.~~
 - c. ~~Distinguish between several types of cheeses, and give examples of each.~~
3. ~~Construct and evaluate several types of sandwiches. (DOK 3)~~
 - a. ~~Give examples of different types of sandwiches.~~
 - b. ~~Identify the three components of a sandwich.~~
 - c. ~~Construct various sandwiches.~~

Unit 7: Fruits, Vegetables, Salads, and Garnishes

1. ~~Demonstrate and evaluate the preparation of fruits. (DOK 2)~~
 - a. ~~Identify, describe, and demonstrate the preparation of different fruits.~~
 - b. ~~List and explain the USDA quality grades for fresh fruit.~~
 - c. ~~Demonstrate the procedures for properly storing ripe fruit.~~
 - d. ~~Summarize ways to prevent fruit from spoiling too quickly.~~
 - e. ~~Match and cook fruit to appropriate cooking methods.~~
 - f. ~~Explain how to prevent enzymatic browning of fruit.~~
2. ~~Demonstrate and evaluate the preparation of vegetables. (DOK 2)~~
 - a. ~~Identify, describe, and demonstrate the preparation of different vegetables.~~
 - b. ~~List and explain the USDA quality grades for fresh vegetables.~~
 - c. ~~Demonstrate the procedures for properly storing ripe vegetables, roots, and tubers.~~
 - d. ~~Summarize ways to prevent vegetables from spoiling too quickly.~~
 - e. ~~Match and prepare vegetables according to appropriate cooking methods.~~
3. ~~Prepare and evaluate various types of salads. (DOK 2)~~
 - a. ~~Identify types of salads.~~
 - b. ~~Identify types of salad greens used in salad preparation.~~
 - c. ~~Identify the parts of a salad.~~
 - d. ~~Compare and contrast types of salads served at different points in the meal.~~
 - e. ~~Demonstrate appropriate methods to clean salad greens.~~
 - f. ~~Prepare and store salads properly.~~
4. ~~Prepare and evaluate salad dressings. (DOK 2)~~
 - a. ~~Differentiate among salad dressings.~~
 - b. ~~Prepare and match dressings to appropriate salads.~~
5. ~~Demonstrate appropriate garnishing techniques. (DOK 3)~~
 - a. ~~Describe the importance of a garnish.~~
 - b. ~~Investigate common ingredients used to garnish.~~
 - c. ~~Design an appropriately garnished plate.~~

Unit 8: Culinary Math

1. ~~Apply basic mathematical calculations to culinary practices. (DOK 2)~~
 - a. ~~Given a list of numbers, add, subtract, multiply, and divide using basic math operations.~~
 - b. ~~Given a list of fractions, decimals, whole numbers, and percentages, add, subtract, multiply, and divide.~~
2. ~~Apply basic mathematical functions to weights and measures. (DOK 4)~~
 - a. ~~Convert recipes from original yield to desired yield using conversion factors.~~
 - b. ~~Calculate recipe yields.~~
3. ~~Apply basic mathematical functions and food handling practices to control food costs. (DOK 3)~~
 - a. ~~Describe and give examples of controllable food costs, fixed costs, semi-variable costs, and variable costs.~~
 - b. ~~Differentiate between the two categories of food purchased: perishable and nonperishable.~~
 - c. ~~Outline and follow basic receiving procedures.~~
 - d. ~~State the appropriate storage guidelines and temperatures for different perishable foods.~~
4. ~~Determine the menu selling price. (DOK 3)~~
 - a. ~~Explore and investigate the relationship between the menu and costs.~~
 - b. ~~Calculate standard portion cost.~~
 - c. ~~Compute and compare the different methods of arriving at menu selling prices to include the food cost percentage method, the average check method, the contribution margin method, and the straight markup method.~~
5. ~~Apply mathematical procedures to revenue control. (DOK 2)~~
 - a. ~~Calculate the average check/cover, and discuss its importance.~~
 - b. ~~Calculate the total guest check including tax and tip.~~
6. ~~Explain and apply principles used in inventory control. (DOK 2)~~
 - a. ~~Determine dollar value of inventory.~~
 - b. ~~Determine daily and monthly food cost and food cost percentage.~~

Unit 9: Orientation

1. ~~Review school and program policies and procedures. (DOK 1)~~
 - a. ~~Discuss the school handbook and all safety procedures for the classroom and building levels.~~
 - b. ~~Review program policies in the classroom and the laboratory.~~
2. ~~Update career/educational plans. (DOK 1)~~
 - a. ~~Revise resume.~~
 - b. ~~Demonstrate effective interviewing skills.~~

- e. Discuss employer expectations.
- 3. Model job retention skills. (DOK 2)
 - a. Discuss diversity in the workplace.
 - b. Explain a job evaluation and how it relates to career advancement and pay.
 - c. Model valued professional workplace characteristics.

Unit 10: Hospitality Industry

- 1. Research the creation of the modern restaurant. (DOK 1)
 - a. Trace the history of the foodservice industry, and explain its relationship to world history.
 - b. Research famous chefs, and note their major accomplishments.
- 2. Compare and contrast American regional cuisines and international cuisines. (DOK 3)
 - a. Analyze the relationship between global cultures and traditions related to food to include religious practices, ethnicity, demographic variables, colonial exploration, and immigration.
- 3. Research the history of foodservice in the United States. (DOK 1)
 - a. Outline the growth of foodservice throughout the history of the United States.
 - b. List historical entrepreneurs who influenced foodservice in the United States.
- 4. Investigate the future of foodservice. (DOK 2)
 - a. List current trends in society, and explain how they influence the foodservice industry.
 - b. Categorize and differentiate among the segments of the foodservice industry.
 - c. Investigate and draw conclusions on the impact of future economic, technological, and social changes in the foodservice industry.
- 5. Analyze the tourism and travel industry, and determine how the industry will change over time. (DOK 4)
 - a. Explain the role of tourism in the hospitality industry.
 - b. Categorize the types of businesses that make up the tourism industry.
 - c. List and discuss why people travel.
 - d. List the different types of transportation and the advantages and disadvantages of each.
 - e. Identify career opportunities offered by the travel and tourism industry.
 - f. List and describe required customer service skills in the travel industry.
- 6. Analyze the lodging industry. (DOK 2)
 - a. Explain the role of lodging in the hospitality industry.
 - b. Identify career opportunities offered by the travel and tourism industry.
 - c. Describe the differences between leisure and business travelers.
 - d. List the characteristics of lodging operations.
 - e. Describe the use of forecasting and overbooking in reservations management.

Unit 11: Potatoes and Grains

- 1. Select and store potatoes, grains, legumes, and pasta. (DOK 2)

- a. ~~Outline methods to select, receive, and store potatoes and grains.~~
- b. ~~Distinguish between different types of wheat.~~
- 2. ~~Create, prepare, and critique classic potato recipes. (DOK 3)~~
 - a. ~~Identify and describe various types of potatoes.~~
 - b. ~~Using a variety of recipes and cooking techniques, prepare potatoes.~~
- 3. ~~Create, prepare, and critique legumes and grain foods. (DOK 3)~~
 - a. ~~Identify and describe the different types of grains and legumes.~~
 - b. ~~Using a variety of recipes and cooking techniques, prepare grains and legumes.~~
- 4. ~~Create and evaluate pasta and dumplings. (DOK 4)~~
 - a. ~~Identify and describe various types of pasta and dumplings.~~
 - b. ~~Using a variety of recipes and cooking techniques, prepare pasta and dumplings.~~

Unit 12: Customer Communication and Service

- 1. ~~Demonstrate various types of high-quality service in the foodservice industry. (DOK 2)~~
 - a. ~~Demonstrate the similarities and differences among American, French, English, Russian, and self-service styles.~~
 - b. ~~Describe and demonstrate table-side preparations such as carving meats and slicing desserts.~~
 - c. ~~Describe traditional service staff, and list the duties and responsibilities of each.~~
 - d. ~~Identify various server tools and the correct way to stock a service station.~~
 - e. ~~Dramatize ways of describing and recommending menu items to guests.~~
 - f. ~~Dramatize ways of effectively resolving customer complaints.~~
 - g. ~~Demonstrate setting and clearing items properly.~~
- 2. ~~Demonstrate personal dining etiquette. (DOK 1)~~
 - a. ~~Identify the various types of dining utensils and their proper use.~~
- 3. ~~Demonstrate positive customer communications. (DOK 2)~~
 - a. ~~List ways to respond to and resolve customer complaints.~~
 - b. ~~List and demonstrate effective writing skills.~~
 - c. ~~Model proper and courteous telephone skills through demonstrations.~~
 - d. ~~State guidelines for communicating effectively during and after a crisis.~~
 - e. ~~Demonstrate effective listening and speaking skills.~~
 - f. ~~List and discuss examples of innovative ways to attract and keep customers.~~
 - g. ~~Demonstrate suggestive selling techniques.~~

Unit 13: Desserts and Baked Goods

- 1. ~~Create, prepare, and evaluate breads. (DOK 3)~~
 - a. ~~Describe the function of common ingredients in baking.~~
 - b. ~~Identify and prepare yeast breads and quick breads.~~
- 2. ~~Create, prepare, and evaluate baked goods. (DOK 3)~~
 - a. ~~Discuss and prepare cakes, cookies, pies, and other desserts.~~

Unit 14: Culinary Business Concepts

1. ~~Apply marketing principles to foodservice. (DOK 3)~~
 - a. ~~Define marketing.~~
 - b. ~~Describe market segmentation.~~
 - c. ~~Differentiate between a restaurant promotion and public relations.~~
2. ~~Develop a menu. (DOK 4)~~
 - a. ~~Define à la carte, table d'hôte, California menu, du jour, and cycle menus.~~
 - b. ~~Organize the information on a menu.~~
 - c. ~~Write and create the layout of a menu.~~
3. ~~Examine the purchasing process. (DOK 1)~~
 - a. ~~Explain the relationship between primary and intermediary sources and retailer.~~
 - b. ~~Explain the difference between formal and informal purchasing processes.~~
4. ~~Develop standard ordering procedures. (DOK 2)~~
 - a. ~~Develop a specification list for items based on inventory information.~~
 - b. ~~Write purchase orders for items to be purchased.~~
5. ~~Explain and defend the decisions to be made when purchasing. (DOK 3)~~
 - a. ~~Explain how production records influence purchasing decisions.~~
 - b. ~~List the criteria for selecting appropriate suppliers.~~
6. ~~Explain the procedures for receiving, storing, and issuing foods and supplies. (DOK 3)~~
 - a. ~~List proper receiving procedures.~~
 - b. ~~Discuss the proper storage procedures for foods and beverages.~~
 - c. ~~Differentiate between the periodic order and perpetual inventory methods.~~
7. ~~Summarize accounting procedures in foodservice. (DOK 2)~~
 - a. ~~Explain the purpose of accounting records.~~
 - b. ~~Define basic accounting transactions and terms.~~
8. ~~Critique income statements. (DOK 2)~~
 - a. ~~Identify information and terms found on income statements.~~
 - b. ~~Explain how to use the information on income statements in the decision-making process.~~
9. ~~Critique balance sheets. (DOK 2)~~
 - a. ~~Identify information and terms found on balance sheets.~~
 - b. ~~Explain how to use the information on a balance sheet in the decision-making process.~~

Unit 15: Meat, Poultry, and Seafood

1. ~~Create, prepare, and evaluate a quality meat product. (DOK 3)~~
 - a. ~~Describe various kinds of meat.~~
 - b. ~~Outline the federal grading systems for meat.~~
 - c. ~~Match various cooking methods with various forms of meat.~~
 - d. ~~Demonstrate proper procedure for purchasing, storing, and preparing meat.~~
2. ~~Prepare and evaluate a quality poultry product. (DOK 3)~~

- a. ~~Describe various kinds of poultry.~~
- b. ~~Outline the federal grading systems for poultry.~~
- c. ~~Match various cooking methods with various forms of poultry.~~
- d. ~~Demonstrate proper procedures for purchasing, storing, and preparing poultry.~~
- 3. ~~Create, prepare, and evaluate a quality fish/seafood product. (DOK 4)~~
 - a. ~~Describe various kinds of fish/seafood.~~
 - b. ~~Outline the federal grading systems for fish/seafood.~~
 - c. ~~Demonstrate proper procedures for purchasing, storing, and preparing fish/seafood.~~
 - d. ~~Match various cooking methods with various forms of fish/seafood.~~

Unit 16: Stocks, Sauces, and Soups

- 1. ~~Create, prepare, and evaluate stocks. (DOK 3)~~
 - a. ~~Identify the four essential parts of stock and the proper ingredients for each.~~
 - b. ~~List and explain the various types of stock and their ingredients.~~
 - c. ~~Demonstrate methods for preparing bones for stock.~~
 - d. ~~List the ways to cool stock properly.~~
 - e. ~~Prepare the ingredients for stock, and cook several kinds of stock.~~
- 2. ~~Create, prepare, and evaluate soups. (DOK 3)~~
 - a. ~~Identify various types of soups, and give examples.~~
 - b. ~~Explain the preparation of the basic ingredients for broth, consommé, purée, clear, and cream soups.~~
 - c. ~~Prepare several kinds of soups.~~
- 3. ~~Create, prepare, and evaluate sauces. (DOK 3)~~
 - a. ~~Identify the grand sauces, and describe other sauces made from them.~~
 - b. ~~List the proper ingredients for sauces.~~
 - c. ~~Prepare several kinds of sauces.~~
 - d. ~~Match sauces to appropriate foods.~~

Culinary Arts Competency Profile

Program CIP: 12.0500

Unit 1: Introduction

- _____ 1. Identify school and program policies and procedures. (DOK 1)
- _____ 2. Identify career and leadership opportunities in the culinary industry. (DOK 1)
- _____ 3. Analyze the importance of service to the culinary industry. (DOK 2)
- _____ 4. Formulate a plan for an effective job search. (DOK 4)

Unit 2: Human Relations Management (Basic Customer Service and Human Resources)

- Determine the skills necessary to provide professional customer service.
- _____ 1. (DOK 3)
 - _____ 2. Demonstrate excellent interpersonal skills. (DOK 2)
 - _____ 3. Analyze supervisory skills related to human resource management. (DOK 4)

Unit 3: Food Safety and Sanitation

- _____ 1. Discuss and relate the importance of food safety to society. (DOK 2)
- _____ 2. Explain the importance of establishing a food safety system. (DOK 1)
- _____ 3. Analyze the flow of food through a foodservice establishment. (DOK 4)
- _____ 4. Maintain a clean and sanitary kitchen. (DOK 1)

Unit 4: Foodservice Equipment, Safety, and Security

- _____ 1. Implement safe work habits to prevent injuries (ongoing). (DOK 3)
- _____ 2. Explain emergency techniques and procedures. (DOK 1)
- _____ 3. Analyze the correct use of hand tools. (DOK 3)
- _____ 4. Develop standard operating procedures, and demonstrate the safe use and maintenance of large equipment. (DOK 2)

Unit 5: Culinary Foundations (Culinary Basics and Nutrition)

- _____ 1. Develop and demonstrate basic food preparation skills. (DOK 2)
- _____ 2. Develop and demonstrate basic food cooking methods. (DOK 2)
- _____ 3. Discuss the components of a healthy diet. (DOK 1)
- _____ 4. Design and produce a well-balanced meal. (DOK 4)

Unit 6: Breakfast Foods, Dairy, and Sandwiches

- _____ 1. Create and evaluate breakfast foods. (DOK 3)
- _____ 2. Demonstrate preparation and handling of dairy products. (DOK 2)
- _____ 3. Construct and evaluate several types of sandwiches. (DOK 3)

Unit 7: Fruits, Vegetables, Salads, and Garnishes

- _____ 1. Demonstrate and evaluate the preparation of fruits. (DOK 2)
- _____ 2. Demonstrate and evaluate the preparation of vegetables. (DOK 2)
- _____ 3. Prepare and evaluate various types of salads. (DOK 2)
- _____ 4. Prepare and evaluate salad dressings. (DOK 2)
- _____ 5. Demonstrate appropriate garnishing techniques. (DOK 3)

Unit 8: Culinary Math

- _____ 1. Apply basic mathematical calculations to culinary practices. (DOK 2)
- _____ 2. Apply basic mathematical functions to weights and measures. (DOK 4)
- _____ 3. Apply basic mathematical functions and food handling practices to control food costs. (DOK 3)
- _____ 4. Determine the menu selling price. (DOK 3)
- _____ 5. Apply mathematical procedures to revenue control. (DOK 2)
- _____ 6. Explain and apply principles used in inventory control. (DOK 2)

Unit 9: Orientation

- _____ 1. Review school and program policies and procedures. (DOK 1)
- _____ 2. Update career/educational plans. (DOK 1)
- _____ 3. Model job retention skills. (DOK 2)

Unit 10: Hospitality Industry

- _____ 1. Research the creation of the modern restaurant. (DOK 1)
- _____ 2. Compare and contrast American regional cuisines and international cuisines. (DOK 3)
- _____ 3. Research the history of foodservice in the United States. (DOK 1)
- _____ 4. Investigate the future of foodservice. (DOK 2)
- _____ 5. Analyze the tourism and travel industry, and determine how the industry will change over time. (DOK 4)
- _____ 6. Analyze the lodging industry. (DOK 2)

Unit 11: Potatoes and Grains

- _____ 1. Select and store potatoes, grains, legumes, and pasta. (DOK 2)
- _____ 2. Create, prepare, and critique classic potato recipes. (DOK 3)
- _____ 3. Create, prepare, and critique legumes and grain foods. (DOK 3)
- _____ 4. Create and evaluate pasta and dumplings. (DOK 4)

Unit 12: Customer Communication and Service

- _____ 1. Demonstrate various types of high-quality service in the foodservice industry.

~~(DOK-2)~~

~~2. Demonstrate personal dining etiquette. (DOK-1)~~

~~3. Demonstrate positive customer communications. (DOK-2)~~

Unit 13: Desserts and Baked Goods

~~1. Create, prepare, and evaluate breads. (DOK-3)~~

~~2. Create, prepare, and evaluate baked goods. (DOK-3)~~

Unit 14: Culinary Business Concepts

~~1. Apply marketing principles to foodservice. (DOK-3)~~

~~2. Develop a menu. (DOK-4)~~

~~3. Examine the purchasing process. (DOK-1)~~

~~4. Develop standard ordering procedures. (DOK-2)~~

~~5. Explain and defend the decisions to be made when purchasing. (DOK-3)~~

~~6. Explain the procedures for receiving, storing, and issuing foods and supplies. (DOK-3)~~

~~7. Summarize accounting procedures in foodservice. (DOK-2)~~

~~8. Critique income statements. (DOK-2)~~

~~9. Critique balance sheets. (DOK-2)~~

Unit 15: Meat, Poultry, and Seafood

~~1. Create, prepare, and evaluate a quality meat product. (DOK-3)~~

~~2. Prepare and evaluate a quality poultry product. (DOK-3)~~

~~3. Create, prepare, and evaluate a quality fish/seafood product. (DOK-4)~~

Unit 16: Stocks, Sauces, and Soups

~~1. Create, prepare, and evaluate stocks. (DOK-3)~~

~~2. Create, prepare, and evaluate soups. (DOK-3)~~

~~3. Create, prepare, and evaluate sauces. (DOK-3)~~

Appendix A: 21st Century Skills Standards

CSS1 21st Century Themes

CS1—Global Awareness

1. Using 21st century skills to understand and address global issues
2. Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
3. Understanding other nations and cultures, including the use of non-English languages

CS2—Financial, Economic, Business and Entrepreneurial Literacy

1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy in society
3. Using entrepreneurial skills to enhance workplace productivity and career options

CS3—Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national, and global levels
3. Understanding the local and global implications of civic decisions

CS4—Health Literacy

1. Obtaining, interpreting, and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

CS5—Environmental Literacy

1. Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water, and ecosystems
2. Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.)
3. Investigate and analyze environmental issues, and make accurate conclusions about effective solutions
4. Take individual and collective action towards addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues)

CSS2 Learning and Innovation Skills

CS6—Creativity and Innovation

1. Think Creatively
2. Work Creatively with Others

~~3. Implement Innovations~~

~~**CS7—Critical Thinking and Problem Solving**~~

~~1. Reason Effectively~~

~~2. Use Systems Thinking~~

~~3. Make Judgments and Decisions~~

~~4. Solve Problems~~

~~**CS8—Communication and Collaboration**~~

~~1. Communicate Clearly~~

~~2. Collaborate with Others~~

~~CSS3 Information, Media and Technology Skills~~

~~**CS9—Information Literacy**~~

~~1. Access and Evaluate Information~~

~~2. Use and Manage Information~~

~~**CS10—Media Literacy**~~

~~1. Analyze Media~~

~~2. Create Media Products~~

~~**CS11—ICT Literacy**~~

~~1. Apply Technology Effectively~~

~~CSS4 Life and Career Skills~~

~~**CS12—Flexibility and Adaptability**~~

~~1. Adapt to change~~

~~2. Be Flexible~~

~~**CS13—Initiative and Self-Direction**~~

~~1. Manage Goals and Time~~

~~2. Work Independently~~

~~3. Be Self-directed Learners~~

~~**CS14—Social and Cross-Cultural Skills**~~

~~1. Interact Effectively with others~~

~~2. Work Effectively in Diverse Teams~~

~~**CS15—Productivity and Accountability**~~

~~1. Manage Projects~~

~~2. Produce Results~~

~~**CS16—Leadership and Responsibility**~~

~~1. Guide and Lead Others~~

~~2. Be Responsible to Others~~

Appendix B: MS Academic Standards

MISSISSIPPI SCIENCE FRAMEWORK COMPETENCIES

Marine and Aquatic Science

- AQ 1 — Apply inquiry-based and problem-solving processes and skills to scientific investigations.
- AQ 2 — Develop an understanding of physical and chemical properties of water and aquatic environments.
- AQ 3 — Apply an understanding of the diverse organisms found in aquatic environments.
- AQ 4 — Draw conclusions about the relationships between human activity and aquatic organisms.

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
- Safety rules and symbols
 - Proper use and care of the compound light microscope, slides, chemicals, etc.
 - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
- b. Formulate questions that can be answered through research and experimental design. (DOK 3)
- c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
- d. Construct and analyze graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
- e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
- f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
- g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

2. Develop an understanding of physical and chemical properties of water and aquatic environments.

- a. Analyze the physical and chemical properties of water, and justify why it is essential to living organisms. (DOK 1)
- b. Explain the causes and characteristics of tides. (DOK 1)
- c. Research, create diagrams, and summarize principles related to waves and current characteristics and formation. (DOK 2)

- d. ~~Compare and contrast the physical and chemical parameters of dissolved O₂, pH, temperature, salinity, and results obtained through analysis of different water column depths/zones. (DOK 2)~~
 - e. ~~Investigate the causes and effects of erosion and discuss conclusions. (DOK 2)~~
 - f. ~~Describe and differentiate among the major geologic features of specific aquatic environments. (DOK 1)~~
 - ~~Plate tectonics~~
 - ~~Rise, slope, elevation, and depth~~
 - ~~Formation of dunes, reefs, barrier/volcanic islands, and coastal/flood plains~~
 - ~~Watershed formation as it relates to bodies of freshwater~~
 - g. ~~Compare and contrast the unique abiotic and biotic characteristics of selected aquatic ecosystems. (DOK 2)~~
 - ~~Barrier island, coral reef, tidal pool, and ocean~~
 - ~~River, stream, lake, pond, and swamp~~
 - ~~Bay, sound, estuary, and marsh~~
- 3. Apply an understanding of the diverse organisms found in aquatic environments.**
- a. ~~Analyze and explain the diversity and interactions among aquatic life. (DOK 3)~~
 - ~~Adaptations of representative organisms for their aquatic environments~~
 - ~~Relationship of organisms in food chains/webs within aquatic environments~~
 - b. ~~Research, calculate, and interpret population data. (DOK 2)~~
 - c. ~~Research and compare reproductive processes in aquatic organisms. (DOK 2)~~
 - d. ~~Differentiate among characteristics of planktonic, nektonic, and benthic organisms. (DOK 1)~~
 - e. ~~Explore the taxonomy of aquatic organisms, and use dichotomous keys to differentiate among the organisms. (DOK 2)~~
 - f. ~~Research and explain the symbiotic relationships in aquatic ecosystems. (DOK 3)~~
- 4. Draw conclusions about the relationships between human activity and aquatic organisms.**
- a. ~~Describe the impact of natural and human activity on aquatic ecosystems, and evaluate the effectiveness of various solutions to environmental problems. (DOK 3)~~
 - ~~Sources of pollution in aquatic environments and methods to reduce the effects of the pollution~~
 - ~~Effectiveness of a variety of methods of environmental management and stewardship~~
 - ~~Effects of urbanization on aquatic ecosystems and the effects of continued expansion~~
 - b. ~~Research and cite evidence of the effects of natural phenomena such as hurricanes, floods, or drought on aquatic habitats and organisms. (DOK 3)~~
 - c. ~~Discuss the advantages and disadvantages involved in applications of modern technology in aquatic science. (DOK 2)~~
 - ~~Careers related to aquatic science~~
 - ~~Modern technology within aquatic science (e.g., mariculture and aquaculture)~~
 - ~~Contributions of aquatic technology to industry and government~~

Biology I

- ~~BIOI 1 — Apply inquiry-based and problem-solving processes and skills to scientific investigations.~~
- ~~BIOI 2 — Describe the biochemical basis of life, and explain how energy flows within and between the living systems.~~
- ~~BIOI 3 — Investigate and evaluate the interaction between living organisms and their environment.~~
- ~~BIOI 4 — Analyze and explain the structures and function of the levels of biological organization.~~
- ~~BIOI 5 — Demonstrate an understanding of the molecular basis of heredity.~~
- ~~BIOI 6 — Demonstrate an understanding of principles that explain the diversity of life and biological evolution.~~

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- ~~a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
 - ~~● Safety rules and symbols~~
 - ~~● Proper use and care of the compound light microscope, slides, chemicals, etc.~~
 - ~~● Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers~~~~
- ~~d. Formulate questions that can be answered through research and experimental design. (DOK 3)~~
- ~~e. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 2)~~
- ~~f. Construct and analyze graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)~~
- ~~g. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)~~
- ~~h. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)~~
- ~~i. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)~~

2. Describe the biochemical basis of life, and explain how energy flows within and between the living systems.

- a. Explain and compare with the use of examples the types of bond formation (e.g., covalent, ionic, hydrogen, etc.) between or among atoms. (DOK 2)
 - Subatomic particles and arrangement in atoms
 - Importance of ions in biological processes
- b. Develop a logical argument defending water as an essential component of living systems (e.g., unique bonding and properties including polarity, high specific heat, surface tension, hydrogen bonding, adhesion, cohesion, and expansion upon freezing). (DOK 2)
- c. Classify solutions as acidic, basic, or neutral, and relate the significance of the pH scale to an organism's survival (e.g., consequences of having different concentrations of hydrogen and hydroxide ions). (DOK 2)
- d. Compare and contrast the structure, properties, and principle functions of carbohydrates, lipids, proteins, and nucleic acids in living organisms. (DOK 2)
 - Basic chemical composition of each group
 - Building components of each group (e.g., amino acids, monosaccharides, nucleotides, etc.)
 - Basic functions (e.g., energy, storage, cellular, heredity) of each group
- e. Examine the life processes to conclude the role enzymes play in regulating biochemical reactions. (DOK 2)
 - Enzyme structure
 - Enzyme function, including enzyme-substrate specificity and factors that affect enzyme function (pH and temperature)
- f. Describe the role of adenosine triphosphate (ATP) in making energy available to cells. (DOK 1)
 - ATP structure
 - ATP function
- g. Analyze and explain the biochemical process of photosynthesis and cellular respiration, and draw conclusions about the roles of the reactant and products in each. (DOK 3)
 - Photosynthesis and respiration (reactants and products)
 - Light dependent reactions and light independent reactions in photosynthesis, including requirements and products of each
 - Aerobic and anaerobic processes in cellular respiration, including products each and energy differences

3. Investigate and evaluate the interaction between living organisms and their environment.

- a. Compare and contrast the characteristics of the world's major biomes (e.g., deserts, tundra, taiga, grassland, temperate forest, tropical rainforest). (DOK 2)
 - Plant and animal species
 - Climate (temperature and rainfall)
 - Adaptations of organisms

- b. Provide examples to justify the interdependence among environmental elements. (DOK 2)
- Biotic and abiotic factors in an ecosystem (e.g., water, carbon, oxygen, mold, leaves)
 - Energy flow in ecosystems (e.g., energy pyramids and photosynthetic organisms to herbivores, carnivores, and decomposers)
 - Roles of beneficial bacteria
 - Interrelationships of organisms (e.g., cooperation, predation, parasitism, commensalism, symbiosis, and mutualism)
- c. Examine and evaluate the significance of natural events and human activities on major ecosystems (e.g., succession, population growth, technology, loss of genetic diversity, consumption of resources). (DOK 2)
- 4. Analyze and explain the structures and function of the levels of biological organization.**
- a. Differentiate among plant and animal cells and eukaryotic and prokaryotic cells. (DOK 2)
- Functions of all major cell organelles and structures (e.g., nucleus, mitochondrion, rough ER, smooth ER, ribosomes, Golgi bodies, vesicles, lysosomes, vacuoles, microtubules, microfilaments, chloroplast, cytoskeleton, centrioles, nucleolus, chromosomes, nuclear membrane, cell wall, cell membrane [active and passive transport], cytosol)
 - Components of mobility (e.g., cilia, flagella, pseudopodia)
- b. Differentiate between types of cellular reproduction. (DOK 1)
- Main events in the cell cycle and cell mitosis (including differences in plant and animal cell divisions)
 - Binary fission (e.g., budding, vegetative propagation, etc.)
 - Significance of meiosis in sexual reproduction
 - Significance of crossing over
- c. Describe and differentiate among the organizational levels of organisms (e.g., cells, tissues, organs, systems, types of tissues.) (DOK 1)
- d. Explain and describe how plant structures (vascular and nonvascular) and cellular functions are related to the survival of plants (e.g., movement of materials, plant reproduction). (DOK 1)
- 5. Demonstrate an understanding of the molecular basis of heredity.**
- a. Analyze and explain the molecular basis of heredity and the inheritance of traits to successive generations by using the Central Dogma of Molecular Biology. (DOK 3)
- Structures of DNA and RNA
 - Processes of replication, transcription, and translation
 - Messenger RNA codon charts
- b. Utilize Mendel's laws to evaluate the results of monohybrid Punnett squares involving complete dominance, incomplete dominance, codominance, sex-linked, and multiple alleles (including outcome percentage of both genotypes and phenotypes). (DOK 2)

- e. Examine inheritance patterns using current technology (e.g., pedigrees, karyotypes, gel electrophoresis). (DOK 2)
 - d. Discuss the characteristics and implications of both chromosomal and gene mutations. (DOK 2)
 - Significance of nondisjunction, deletion, substitutions, translocation, frame shift mutation in animals
 - Occurrence and significance of genetic disorders such as sickle cell anemia, Tay-Sachs disorder, cystic fibrosis, hemophilia, Down syndrome, color blindness
- 6. Demonstrate an understanding of principles that explain the diversity of life and biological evolution.**
- a. Draw conclusions about how organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their evolutionary relationships. (DOK 2)
 - Characteristics of the six kingdoms
 - Major levels in the hierarchy of taxa (e.g., kingdom, phylum/division, class, order, family, genus, and species)
 - Body plans (symmetry)
 - Methods of sexual reproduction (e.g., conjugation, fertilization, pollination)
 - Methods of asexual reproduction (e.g., budding, binary fission, regeneration, spore formation)
 - b. Critique data (e.g., comparative anatomy, Biogeography, molecular biology, fossil record, etc.) used by scientists (e.g., Redi, Needham, Spallanzani, Pasteur) to develop an understanding of evolutionary processes and patterns. (DOK 3)
 - c. Research and summarize the contributions of scientists (including Darwin, Malthus, Wallace, Lamarck, and Lyell) whose work led to the development of the theory of evolution. (DOK 2)
 - d. Analyze and explain the roles of natural selection, including the mechanisms of speciation (e.g., mutations, adaptations, geographic isolation) and applications of speciation (e.g., pesticide and antibiotic resistance). (DOK 3)
 - e. Differentiate among chemical evolution, organic evolution, and the evolutionary steps along the way to aerobic heterotrophs and photosynthetic autotrophs. (DOK 2)

Biology II

- BIOII 1 — Apply inquiry based and problem solving processes and skills to scientific investigations.
- BIOII 2 — Describe and contrast the structures, functions, and chemical processes of the cell.
- BIOII 3 — Investigate and discuss the molecular basis of heredity.
- BIOII 4 — Demonstrate an understanding of the factors that contribute to evolutionary theory and natural selection.
- BIOII 5 — Develop an understanding of organism classification.

1. Apply inquiry based and problem solving processes and skills to scientific investigations.

- a. Use current technologies such as CD-ROM, DVD, Internet, and on-line data search to explore current research related to a specific topic. (DOK 3)
 - b. Clarify research questions and design laboratory investigations. (DOK 3)
 - c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
 - d. Organize data to construct graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
 - e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
 - f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
 - g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.). (DOK 3)
- 2. Describe and contrast the structures, functions, and chemical processes of the cell.**
- a. Relate the structure and function of a selectively permeable membrane to its role in diffusion and osmosis. (DOK 2)
 - b. Summarize how cell regulation controls and coordinates cell growth and division. (DOK 2)
 - c. Analyze and describe the function of enzymes in biochemical reactions. (DOK 2)
 - The impact of enzymatic reactions on biochemical processes
 - Factors that affect enzyme function (e.g., pH, concentration, temperature, etc.)
 - d. Differentiate between photosynthesis and cellular respiration. (DOK 2)
 - Cellular sites and major pathways of anaerobic and aerobic respiration (with reactants, products, and ATP per monosaccharide)
 - Cellular respiration with respect to the sites at which they take place, the reactions involved, and the energy input and output in each stage (e.g., glycolysis, Krebs cycle, electron transport chain)
 - Pigments, absorption, reflection of light, and light dependent and light independent reactions of photosynthesis
 - Oxidation and reduction reactions
- 3. Investigate and discuss the molecular basis of heredity.**
- a. Explain how the process of meiosis clarifies the mechanism underlying Mendel's conclusions about segregation and independent assortment on a molecular level. (DOK 4)
 - b. Research and explain how major discoveries led to the determination of DNA structure. (DOK 2)
 - c. Relate gene expression (e.g., replication, transcription, translation) to protein structure and function. (DOK 2)
 - Translation of a messenger RNA strand into a protein
 - Processing by organelles so that the protein is appropriately packaged, labeled, and eventually exported by the cell

- Messenger RNA codon charts to determine the effects of different types of mutations on amino acid sequence and protein structure (e.g., sickle cell anemia resulting from base substitution mutation)
 - Gene expression regulated in organisms so that specific proteins are synthesized only when they are needed by the cell (e.g., allowing cell specialization)
- d. Assess the potential implications of DNA technology with respect to its impact on society. (DOK 3)
- Modern DNA technologies (e.g., polymerase chain reaction (PCR), gene splicing, gel electrophoresis, transformation, recombinant DNA) in agriculture, medicine, and forensics
- e. Develop a logical argument defending or refuting bioethical issues arising from applications of genetic technology (e.g., the human genome project, cloning, gene therapy, stem cell research). (DOK 3)
- 4. Demonstrate an understanding of the factors that contribute to evolutionary theory and natural selection.**
- a. Explain the history of life on earth, and infer how geological changes provide opportunities and constraints for biological evolution. (DOK 2)
- Main periods of the geologic timetable of earth's history
 - Roles of catastrophic and gradualistic processes in shaping planet Earth
- b. Provide support for the argument based upon evidence from anatomy, embryology, biochemistry, and paleontology that organisms descended with modification from common ancestry. (DOK 2)
- c. Identify and provide supporting evidence for the evolutionary relationships among various organisms using phylogenetic trees and cladograms. (DOK 2)
- d. Formulate a scientific explanation based on fossil records of ancient life forms, and describe how new species could originate as a result of geological isolation and reproductive isolation. (DOK 2)
- e. Compare and contrast the basic types of selection (e.g., disruptive, stabilizing, directional, etc.). (DOK 2)
- f. Cite examples to justify behaviors that have evolved through natural selection (e.g., migration, parental care, use of tools, etc.). (DOK 1)
- g. Research and explain the contributions of 19th century scientists (e.g., Malthus, Wallace, Lyell, and Darwin) on the formulation of ideas about evolution. (DOK 2)
- h. Develop a logical argument describing ways in which the influences of 20th century science have impacted the development of ideas about evolution (e.g., synthetic theory of evolution, molecular biology). (DOK 3)
- i. Analyze changes in an ecosystem resulting from natural causes (succession), changes in climate, human activity (pollution and recycling), or introduction of nonnative species. (DOK 2)
- 5. Develop an understanding of organism classification.**
- a. Classify organisms according to traditional Linnaean classification characteristics (e.g., cell structure, biochemistry, anatomy, fossil record, methods of reproduction) and the cladistic approach. (DOK 2)
- b. Categorize organisms according to the characteristics that distinguish them as Bacteria, Archaea, or Eucarya. (DOK 1)

- ~~Bacteria, fungi, and protists~~
- ~~Characteristics of invertebrates (e.g., habitat, reproduction, body plan, locomotion) as related to phyla (e.g., Porifera, Cnidarians, Nematoda, Annelida, Platyhelminthes, and Arthropoda) and classes (e.g., Insecta, Crustacea, Arachnida, Mollusca, Echinodermata)~~
- ~~Characteristics of vertebrates (e.g., habitat, reproduction, body plan, locomotion) as related to classes (e.g., Agnatha, Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves, Mammalia)~~
- ~~Nomenclature of various types of plants (e.g., Bryophyta, Tracheophyta, Gymnospermae, Angiospermae, Monocotyledonae, Dicotyledonae, vascular plants, nonvascular plants)~~

Botany

- ~~BO 1 — Apply inquiry-based and problem-solving processes and skills to scientific investigations.~~
- ~~BO 2 — Distinguish among the characteristics of botanical organization, structure, and function.~~
- ~~BO 3 — Demonstrate an understanding of plant reproduction.~~
- ~~BO 4 — Draw conclusions about the factors that affect the adaptation and survival of plants.~~
- ~~BO 5 — Relate an understanding of plant genetics to its uses in modern living.~~

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- ~~a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)~~
- ~~Safety rules and symbols~~
 - ~~Proper use and care of the compound light microscope, slides, chemicals, etc.~~
 - ~~Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers~~
- ~~b. Formulate questions that can be answered through research and experimental design. (DOK 3)~~
- ~~c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)~~
- ~~d. Construct and analyze graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)~~
- ~~e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)~~
- ~~f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)~~
- ~~g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)~~

2. Distinguish among the characteristics of botanical organization, structure, and function.

- a. Relate plant cell structures to their functions (e.g., major organelles, cell wall components, photosynthetic chemical reactions, plant pigments, plant tissues, roots, stems, leaves, flowers). (DOK 1)
- b. Differentiate the characteristics found in various plant divisions. (DOK 2)
 - Differences and similarities of nonvascular plants
 - Characteristics of seed-bearing and non-seed-bearing vascular plants relative to taxonomy
 - Major vegetative structures and their modifications in angiosperms and gymnosperms
- c. Compare and contrast leaf modifications of gymnosperms and angiosperms (e.g., needles, overlapping scales, simple leaves, compound leaves, evergreen trees, and deciduous trees). (DOK 2)
- d. Apply the modern classification scheme utilized in naming plants to identify plant specimens. (DOK 2)
 - Classification scheme used in botany
 - Classification of native Mississippi plants
- e. Use inquiry to investigate and discuss the physical and chemical processes of plants. (DOK 3)
 - Relationships among photosynthesis, cellular respiration, and translocation
 - Importance of soil type and soil profiles to plant survival
 - Mechanism of water movement in plants
 - Effects of environmental conditions for plant survival
 - Tropic responses of a plant organ to a given stimulus

3. Demonstrate an understanding of plant reproduction.

- a. Compare and contrast reproductive structures (e.g., cones, flowers). (DOK 2)
- b. Differentiate among the vegetative organs of monocots, herbaceous dicots, and woody dicots. (DOK 1)
- c. Differentiate between the structures and processes of sexual and asexual reproduction in plants. (DOK 1)
 - Reproductive structures, their modifications, and the mechanisms involved in plant reproduction
 - Functions of flower parts, seeds, cones
 - Spore production in bryophytes and ferns
- d. Explain and provide examples of the concept of alternation of generations and its examples. (DOK 2)
- e. Categorize types of fruits and methods of seed distribution in plants. (DOK 1)
- f. Research and compare various methods of plant propagation. (DOK 2)

4. Draw conclusions about the factors that affect the adaptation and survival of plants.

- a. List and assess several adaptations of plants to survive in a given biome. (DOK 2)
- b. Design and conduct an experiment to determine the effects of environmental factors on photosynthesis. (DOK 3)

- c. Explain how natural selection and the evolutionary consequences (e.g., adaptation or extinction) support scientific explanations for similarities of ancient life forms in the fossil record and molecular similarities present in living organisms. (DOK 2)
- d. Research factors that might influence or alter plant stability, and propose actions that may reduce the negative impacts of human activity. (DOK 2)

5. Relate an understanding of plant genetics to its uses in modern living.

- a. Research, prepare, and present a position relating to issues surrounding the current botanical trends involving biotechnology. (DOK 3)
- b. Apply an understanding of the principles of plant genetics to analyze monohybrid and dihybrid crosses, and predict the potential effects the crosses might have on agronomy and agriculture. (DOK 3)
- c. Discuss the effects of genetic engineering of plants on society. (DOK 2)
- d. Describe the chemical compounds extracted from plants, their economical importance, and the impact on humans. (DOK 3)
 - Plant extracts, their function, and origin
 - Impact of the timber industry on local and national economy

Chemistry I

- CHI 1 — Apply inquiry-based and problem-solving processes and skills to scientific investigations.
- CHI 2 — Demonstrate an understanding of the atomic model of matter by explaining atomic structure and chemical bonding.
- CHI 3 — Develop an understanding of the periodic table.
- CHI 4. — Analyze the relationship between microscopic and macroscopic models of matter.
- CHI 5 — Compare factors associated with acid/base and oxidation/reduction reactions.

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- a. Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)
- b. Clarify research questions and design laboratory investigations. (DOK 3)
- c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
- d. Organize data to construct graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
- e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
- f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
- g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.). (DOK 3)

2. Demonstrate an understanding of the atomic model of matter by explaining atomic structure and chemical bonding.

- a. Describe and classify matter based on physical and chemical properties and interactions between molecules or atoms. (DOK 1)
 - Physical properties (e.g., melting points, densities, boiling points) of a variety of substances
 - Substances and mixtures
 - Three states of matter in terms of internal energy, molecular motion, and the phase transitions between them
- b. Research and explain crucial contributions and critical experiments of Dalton, Thomson, Rutherford, Bohr, de Broglie, and Schrödinger, and describe how each discovery contributed to the current model of atomic and nuclear structure. (DOK 2)
- c. Develop a model of atomic and nuclear structure based on theory and knowledge of fundamental particles. (DOK 2)
 - Properties and interactions of the three fundamental particles of the atom
 - Laws of conservation of mass, constant composition, definite proportions, and multiple proportions
- d. Write appropriate equations for nuclear decay reactions, describe how the nucleus changes during these reactions, and compare the resulting radiation with regard to penetrating ability. (DOK 1)
 - Three major types of radioactive decay (e.g., alpha, beta, gamma) and the properties of the emissions (e.g., composition, mass, charge, penetrating power)
 - The concept of half-life for a radioactive isotope (e.g., carbon-14 dating) based on the principle that the decay of any individual atom is a random process
- e. Compare the properties of compounds according to their type of bonding. (DOK 1)
 - Covalent, ionic, and metallic bonding
 - Polar and nonpolar covalent bonding
 - Valence electrons and bonding atoms
- f. Compare different types of intermolecular forces, and explain the relationship between intermolecular forces, boiling points, and vapor pressure when comparing differences in properties of pure substances. (DOK 1)
- g. Develop a three-dimensional model of molecular structure. (DOK 2)
 - Lewis dot structures for simple molecules and ionic compounds
 - Valence shell electron pair repulsion theory (VSEPR)

3. Develop an understanding of the periodic table.

- a. Calculate the number of protons, neutrons, and electrons in individual isotopes using atomic numbers and mass numbers, write electron configurations of elements and ions following the Aufbau principle, and balance equations representing nuclear reactions. (DOK 1)
- b. Analyze patterns and trends in the organization of elements in the periodic table, and compare their relationship to position in the periodic table. (DOK 2)
 - Atomic number, atomic mass, mass number, and number of protons, electrons, and neutrons in isotopes of elements
 - Average atomic mass calculations

- ~~Chemical characteristics of each region~~
 - ~~Periodic properties (e.g., metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity, electron affinity, ionization energy, atomic/covalent/ionic radius)~~
 - e. ~~Classify chemical reactions by type. (DOK 2)~~
 - ~~Single displacement, double displacement, synthesis (combination), decomposition, disproportionation, combustion, or precipitation~~
 - ~~Products (given reactants) or reactants (given products) for each reaction type~~
 - ~~Solubility rules for precipitation reactions and the activity series for single and double displacement reactions~~
 - d. ~~Use stoichiometry to calculate the amount of reactants consumed and products formed. (DOK 3)~~
 - ~~Difference between chemical reactions and chemical equations~~
 - ~~Formulas and calculations of the molecular (molar) masses~~
 - ~~Empirical formula given the percent composition of elements~~
 - ~~Molecular formula given the empirical formula and molar mass~~
- 4. Analyze the relationship between microscopic and macroscopic models of matter.**
- a. ~~Calculate the number of protons, neutrons, and electrons in individual isotopes using atomic numbers and mass numbers, write electron configurations of elements and ions following the Aufbau principle, and balance equations representing nuclear reactions. (DOK 1)~~
 - b. ~~Analyze patterns and trends in the organization of elements in the periodic table, and compare their relationship to position in the periodic table. (DOK 2)~~
 - ~~Atomic number, atomic mass, mass number, and number of protons, electrons, and neutrons in isotopes of elements~~
 - ~~Average atomic mass calculations~~
 - ~~Chemical characteristics of each region~~
 - ~~Periodic properties (e.g., metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity, electron affinity, ionization energy, atomic/covalent/ionic radius)~~
 - e. ~~Classify chemical reactions by type. (DOK 2)~~
 - ~~Single displacement, double displacement, synthesis (combination), decomposition, disproportionation, combustion, or precipitation~~
 - ~~Products (given reactants) or reactants (given products) for each reaction type~~
 - ~~Solubility rules for precipitation reactions and the activity series for single and double displacement reactions~~
 - d. ~~Use stoichiometry to calculate the amount of reactants consumed and products formed. (DOK 3)~~
 - ~~Difference between chemical reactions and chemical equations~~
 - ~~Formulas and calculations of the molecular (molar) masses~~
 - ~~Empirical formula given the percent composition of elements~~
 - ~~Molecular formula given the empirical formula and molar mass~~
- 5. Compare factors associated with acid/base and oxidation/reduction reactions.**
- a. ~~Analyze and explain acid/base reactions. (DOK 2)~~

- Properties of acids and bases, including how they affect indicators and the relative pH of the solution
 - Formation of acidic and basic solutions
 - Definition of pH in terms of the hydronium ion concentration and the hydroxide ion concentration
 - The pH or pOH from the hydrogen ion or hydroxide ion concentrations of solution
 - How a buffer works and examples of buffer solutions
- b. Classify species in aqueous solutions according to the Arrhenius and Bronsted-Lowry definitions respectively, and predict products for aqueous neutralization reactions. (DOK 2)
- c. Analyze a reduction/oxidation reaction (REDOX) to assign oxidation numbers (states) to reaction species, and identify the species oxidized and reduced, the oxidizing agent, and reducing agent. (DOK 2)

Organic Chemistry

- ORGC 1—Apply inquiry based and problem-solving processes and skills to scientific investigations.
- ORGC 2—Demonstrate an understanding of the properties, structure, and function of organic compounds.
- ORGC 3—Discuss the versatility of polymers and the diverse application of organic chemicals.

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
- Safety rules and symbols
 - Proper use and care of the compound light microscope, slides, chemicals, etc.
 - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
- b. Formulate questions that can be answered through research and experimental design. (DOK 3)
- c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
- d. Organize data to construct graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
- e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
- f. Recognize and analyze alternative explanations for experimental results, and make predictions based on observations and prior knowledge. (DOK 3)
- g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

2. Demonstrate an understanding of the properties, structure, and function of organic compounds.

- a. Apply International Union of Pure and Applied Chemistry (IUPAC) nomenclature, and differentiate the structure of aliphatic, aromatic, and cyclic hydrocarbon compounds. (DOK 1)
- Structures of hydrocarbon compounds
 - Isomerism in hydrocarbon compounds
- b. Relate structure to physical and chemical properties of hydrocarbon. (DOK 1)
- c. Apply principles of geometry and hybridization to organic molecules. (DOK 2)
- Lewis structures for organic molecules
 - Bond angles
 - Hybridization (as it applies to organic molecules)
- d. Write, complete, and classify common reactions for aliphatic, aromatic, and cyclic hydrocarbons. (DOK 1)
- e. Construct, solve, and explain equations representing combustion reactions, substitution reactions, dehydrogenation reactions, and addition reactions. (DOK 2)
- f. Classify functional groups (e.g., alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, amides, and nitriles) by their structure and properties. (DOK 2)
- Structural formulas from functional group names and vice versa
 - Chemical and physical properties of compounds containing functional groups
 - Equations representing the transformation of one functional group into another

3. Discuss the versatility of polymers and the diverse application of organic chemicals.

- a. Describe and classify the synthesis, properties, and uses of polymers. (DOK 2)
- Common polymers
 - Synthesis of polymers from monomers by addition or condensation
 - Condensations of plastics according to their commercial types
 - Elasticity and other polymer properties
- b. Develop a logical argument supporting the use of organic chemicals and their application in industry, drug manufacture, and biological chemistry. (DOK 1)
- Common uses of polymers and organic compounds in medicine, drugs, and personal care products
 - Compounds that have the property to dye materials
 - Petrochemical production
 - Biologically active compounds in terms of functional group-substrate interaction
- c. Research and summarize the diversity, applications, and economics of industrial chemicals (solvents, coatings, surfactants, etc.). (DOK 3)

Earth and Space Science

- E1 Apply inquiry-based and problem-solving processes and skills to scientific investigations.
- E2 Develop an understanding of the history and evolution of the universe and earth.
- E3 Discuss factors that are used to explain the geological history of earth.
- E4 Demonstrate an understanding of earth systems relating to weather and climate.

E5 Apply an understanding of ecological factors to explain relationships between earth systems.

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
 - Safety rules and symbols
 - Proper use and care of the compound light microscope, slides, chemicals, etc.
 - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers.
- b. Formulate questions that can be answered through research and experimental design. (DOK 3)
- c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
- d. Construct and analyze graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
- e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
- f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
- g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

2. Develop an understanding of the history and evolution of the universe and earth.

- a. Summarize the origin and evolution of the universe. (DOK 2)
 - Big bang theory
 - Microwave background radiation
 - The Hubble constant
 - Evidence of the existence of dark matter and dark energy in the universe and the history of the universe
- b. Differentiate methods used to measure space distances, including astronomical unit, light-year, stellar parallax, Cepheid variables, and the red shift. (DOK 1)
- c. Interpret how gravitational attraction played a role in the formation of the planetary bodies and how the fusion of hydrogen and other processes in “ordinary” stars and supernovae lead to the formation of all other elements. (DOK 2)
- d. Summarize the early evolution of the earth, including the formation of Earth’s solid layers (e.g., core, mantle, and crust), the distribution of major elements, the origin of internal heat sources, and the initiation of plate tectonics. (DOK 2)
 - How the decay of radioactive isotopes is used to determine the age of rocks, earth, and the solar system
 - How Earth acquired its initial oceans and atmosphere

3. Discuss factors which are used to explain the geological history of earth.

- a. ~~Develop an understanding of how plate tectonics create certain geological features, materials, and hazards. (DOK 1)~~
 - ~~Plate tectonic boundaries (e.g., divergent, convergent, and transform)~~
 - ~~Modern and ancient geological features to each kind of plate tectonic boundary~~
 - ~~Production of particular groups of igneous and metamorphic rocks and mineral resources~~
 - ~~Sedimentary basins created and destroyed through time~~
- b. ~~Compare and contrast types of mineral deposits/groups (e.g., oxides, carbonates, halides, sulfides, sulfates, silicates, phosphates). (DOK 2)~~
- c. ~~Categorize minerals and rocks by determining their physical and/or chemical characteristics. (DOK 2)~~
- d. ~~Justify the causes of certain geological hazards (e.g., earthquakes, volcanoes, tsunamis) to their effects on specific plate tectonic locations. (DOK 2)~~
- e. ~~Interpret and explain how rock relationships and fossils are used to reconstruct the geologic history of the earth. (DOK 2)~~
- f. ~~Apply principles of relative age (e.g., superposition, original horizontality, crosscutting relations, and original lateral continuity) to support an opinion related to earth's geological history. (DOK 3)~~
 - ~~Types of unconformity (e.g., disconformity, angular unconformity, nonconformity)~~
 - ~~Geological timetable~~
- g. ~~Apply the principle of uniformitarianism to relate sedimentary rock associations and their fossils to the environments in which the rocks were deposited. (DOK 2)~~
- h. ~~Compare and contrast the relative and absolute dating methods (e.g., the principle of fossil succession, radiometric dating, and paleomagnetism) for determining the age of the earth. (DOK 1)~~
- 4. Demonstrate an understanding of earth systems relating to weather and climate.**
 - a. ~~Explain the interaction of earth systems that affect weather and climate. (DOK 1)~~
 - ~~Latitudinal variations in solar heating~~
 - ~~The effects of Coriolis forces on ocean currents, cyclones, anticyclones, ocean currents, topography, and air masses (e.g., warm fronts, cold fronts, stationary fronts, and occluded fronts).~~
 - b. ~~Interpret the patterns in temperature and precipitation that produce the climate regions on earth, and relate them to the hazards associated with extreme weather events and climate change (e.g., hurricanes, tornadoes, El Niño/La Niña, global warming). (DOK 2)~~
 - c. ~~Justify how changes in global climate and variation in earth/sun relationships contribute to natural and anthropogenic (human caused) modification of atmospheric composition. (DOK 2)~~
 - d. ~~Summarize how past and present actions of ice, wind, and water contributed to the types and distributions of erosional and depositional features in landscapes. (DOK 1)~~
 - e. ~~Research and explain how external forces affect earth's topography. (DOK 2)~~
 - ~~How surface water and groundwater act as the major agents of physical and chemical weathering~~
 - ~~How soil results from weathering and biological processes~~
 - ~~Processes and hazards associated with both sudden and gradual mass wasting~~

5. Apply an understanding of ecological factors to explain relationships between earth systems.

- a. Draw conclusions about how life on earth shapes earth systems and responds to the interaction of earth systems (lithosphere, hydrosphere, atmosphere, and biosphere). (DOK 3)
- Nature and distribution of life on earth, including humans, to the chemistry and availability of water
 - Distribution of biomes (e.g., terrestrial, freshwater, and marine) to climate regions through time
 - Geochemical and ecological processes (e.g., rock, hydrologic, carbon, nitrogen) that interact through time to cycle matter and energy and how human activity alters the rates of these processes (e.g., fossil fuel formation and combustion, damming and channeling of rivers)
- b. Interpret the record of shared ancestry (fossils), evolution, and extinction as related to natural selection. (DOK 2)
- c. Identify the cause and effect relationships of the evolutionary innovations that most profoundly shaped earth systems. (DOK 1)
- Photosynthesis and the atmosphere
 - Multicellular animals and marine environments
 - Land plants and terrestrial environments
- d. Cite evidence about how dramatic changes in earth's atmosphere influenced the evolution of life. (DOK 1)

Environmental Science

- ES 1 Apply inquiry-based and problem-solving processes and skills to scientific investigations.
- ES 2 Develop an understanding of the relationship of ecological factors that affect an ecosystem.
- ES 3 Discuss the impact of human activities on the environment, conservation activities, and efforts to maintain and restore ecosystems.

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
- Safety rules and symbols
 - Proper use and care of the compound light microscope, slides, chemicals, etc.
 - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
- b. Formulate questions that can be answered through research and experimental design. (DOK 3)

- e. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
- d. Construct and analyze graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
- e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
- f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
- g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

2. Develop an understanding of the relationship of ecological factors that affect an ecosystem.

- a. Compare ways in which the three layers of the biosphere change over time and their influence on an ecosystem's ability to support life. (DOK 2)
- b. Explain the flow of matter and energy in ecosystems. (DOK 2)
 - Interactions between biotic and abiotic factors
 - Indigenous plants and animals and their roles in various ecosystems
 - Biogeochemical cycles within the environment
- c. Predict the impact of the introduction, removal, and reintroduction of an organism on an ecosystem. (DOK 3)
- d. Develop a logical argument explaining the relationships and changes within an ecosystem. (DOK 2)
 - How a species adapts to its niche
 - Process of primary and secondary succession and its effects on a population
 - How changes in the environment might affect organisms
- e. Explain the causes and effects of changes in population dynamics (e.g., natural selection, exponential growth, predator/prey relationships) to carrying capacity and limiting factors. (DOK 2)
- f. Research and explain how habitat destruction leads to the loss of biodiversity. (DOK 2)
- g. Compare and contrast the major biomes of the world's ecosystems, including location, climate, adaptations and diversity. (DOK 1)

3. Discuss the impact of human activities on the environment, conservation activities, and efforts to maintain and restore ecosystems.

- a. Summarize the effects of human activities on resources in the local environments. (DOK 2)
 - Sources, uses, quality, and conservation of water
 - Renewable and nonrenewable resources
 - Effects of pollution (e.g., water, noise, air, etc.) on the ecosystem
- b. Research and evaluate the impacts of human activity and technology on the lithosphere, hydrosphere, and atmosphere, and develop a logical argument to support how communities restore ecosystems. (DOK 3)

- e. ~~Research and evaluate the use of renewable and nonrenewable resources, and critique efforts to conserve natural resources and reduce global warming in the United States including (but not limited) to Mississippi. (DOK 3)~~

Genetics

- G 1 ~~Apply inquiry-based and problem-solving processes and skills to scientific investigations.~~
- G 2 ~~Analyze the structure and function of the cell and cellular organelles.~~
- G 3 ~~Apply the principles of heredity to demonstrate genetic understandings.~~

1. Use critical thinking and scientific problem solving in designing and performing biological research and experimentation. (L, P, E)

- a. ~~Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)~~
- b. ~~Clarify research questions and design laboratory investigations. (DOK 3)~~
- c. ~~Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)~~
- d. ~~Organize data to construct graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for pie, bar, and line graphs) to draw conclusions and make inferences. (DOK 3)~~
- e. ~~Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)~~
- f. ~~Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)~~
- g. ~~Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.). (DOK 3)~~

2. Review the structure and function of the cell as it applies to genetics. (L)

- a. ~~Cite evidence to illustrate how the structure and function of cells are involved in the maintenance of life. (DOK 2)~~
- b. ~~Describe how organic components are integral to biochemical processes. (DOK 2)~~
- c. ~~Differentiate among the processes by which plants and animals reproduce. (DOK 1)~~
- ~~Cell cycle and mitosis~~
 - ~~Meiosis, spermatogenesis, and oogenesis~~
- d. ~~Explain the significance of the discovery of nucleic acids. (DOK 1)~~
- e. ~~Analyze and explain the structure and function of DNA and RNA in replication, transcription, translation and DNA repair. (DOK 2)~~
- f. ~~Cite examples to compare the consequences of the different types of mutations. (DOK 1)~~
- g. ~~Draw conclusions about the importance and potential impacts of the process of gene transfer used in biotechnology. (DOK 3)~~

3. Analyze the structure and function of DNA and RNA molecules. (L, P)

- a. ~~Cite evidence that supports the significance of Mendel's concept of "particulate inheritance" to explain the understanding of heredity. (DOK 1)~~
- b. ~~Apply classical genetics principles to solve basic genetic problems. (DOK 2)~~

- Genes and alleles, dominance, recessiveness, the laws of segregation, and independent assortment
 - Inheritance of autosomal and sex-linked traits
 - Inheritance of traits influenced by multiple alleles and traits with polygenic inheritance
 - Chromosomal theory of inheritance
- c. Apply population genetic concepts to summarize variability of multicellular organisms. (DOK 2)
- Genetic variability
 - Hardy-Weinberg formula
 - Migration and genetic drift
 - Natural selection in humans
- d. Distinguish and explain the applications of various tools and techniques used in DNA manipulation. (DOK 1)
- Steps in genetic engineering experiments
 - Use of restriction enzymes
 - Role of vectors in genetic research
 - Use of transformation techniques
- e. Research and present a justifiable explanation the practical uses of biotechnology (e.g., chromosome mapping, karyotyping, and pedigrees). (DOK 2)
- f. Develop and present a scientifically based logical argument for or against moral and ethical issues related to genetic engineering. (DOK 3)
- g. Research genomics (human and other organisms), and predict benefits and medical advances that may result from the use of genome projects. (DOK 2)

Geology

-
- GE1 Apply inquiry-based and problem-solving processes and skills to scientific investigations.
- GE2 Develop an understanding of plate tectonics and geochemical and ecological processes that affect earth.

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
- Safety rules and symbols
 - Proper use and care of the compound light microscope, slides, chemicals, etc.
 - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
- b. Formulate questions that can be answered through research and experimental design. (DOK 3)

- e. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
- d. Construct and analyze graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
- e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
- f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
- g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

2. Develop an understanding of plate tectonics and geochemical and ecological processes that affect earth.

- a. Differentiate the components of the earth's atmosphere and lithosphere. (DOK 1)
- b. Research and summarize explanations of how earth acquired its initial atmosphere and oceans. (DOK 2)
- c. Compare the causes and effects of internal and external components that shape earth's topography. (DOK 2)
 - Physical weathering (e.g., atmospheric, glacial, etc.)
 - Chemical weathering agents (e.g., acid precipitation, carbon dioxide, oxygen, water, etc.)
- d. Develop an understanding of how plate tectonics create certain geologic features, materials, and hazards. (DOK 2)
 - Types of crustal movements and the resulting landforms (e.g., seafloor spreading, paleomagnetic measurements, and orogenesis)
 - Processes that create earthquakes and volcanoes
 - Asthenosphere
- e. Summarize the theories of plate development and continental drift, and describe the causes and effects involved in each. (DOK 2)
- f. Develop a logical argument to explain how geochemical and ecological processes (e.g., rock, hydrologic, carbon, nitrogen) interact through time to cycle matter and energy and how human activity alters the rates of these processes (e.g., fossil fuel formation and combustion, damming, and channeling of rivers). (DOK 2)
- g. Interpret how the earth's geological time scale relates to geological history, landforms, and life forms. (DOK 2)
- h. Research and describe different techniques for determining relative and absolute age of the earth (e.g., index of fossil layers, superposition, radiometric dating, etc.). (DOK 1)
- i. Summarize the geological activity of the New Madrid fault line, and compare and contrast it to geological activity in other parts of the world. (DOK 2)
- j. Identify and differentiate the major geological features in Mississippi (e.g., Delta, Coastal Areas, etc.). (DOK 1)
- k. Evaluate an emergency preparedness plan for natural disasters associated with crustal movement. (DOK 3)

Physical Science

- PS 1 ——— Apply inquiry based and problem-solving processes and skills to scientific investigations.
- PS 2 ——— Describe and explain how forces affect motion.
- PS 3 ——— Demonstrate an understanding of general properties and characteristics of waves.
- PS 4 ——— Develop an understanding of the atom.
- PS 5 ——— Investigate and apply principles of physical and chemical changes in matter.

1. Apply inquiry based and problem-solving processes and skills to scientific investigations.

- a. Use appropriate laboratory safety symbols and procedures to design and conduct a scientific investigation. (DOK 2)
- Safety symbols and safety rules in all laboratory activities
 - Proper use and care of the compound light microscope
 - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
- b. Identify questions that can be answered through scientific investigations. (DOK 3)
- c. Identify and apply components of scientific methods in classroom investigations. (DOK 3)
- Predicting, gathering data, drawing conclusions
 - Recording outcomes and organizing data from a variety of sources (e.g., scientific articles, magazines, student experiments, etc.)
 - Critically analyzing current investigations/problems using periodicals and scientific scenarios
- d. Interpret and generate graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
- e. Analyze procedures and data to draw conclusions about the validity of research. (DOK 3)
- f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
- g. Communicate effectively to present and explain scientific results, using appropriate terminology and graphics. (DOK 3)

2. Describe and explain how forces affect motion.

- a. Demonstrate and explain the basic principles of Newton's three laws of motion including calculations of acceleration, force, and momentum. (DOK 2)
- Inertia and distance-time graphs to determine average speed
 - Net force (accounting for gravity, friction, and air resistance) and the resulting motion of objects
 - Effects of the gravitational force on objects on Earth and effects on planetary and lunar motion
 - Simple harmonic motion (oscillation)
- b. Explain the connection between force, work, and energy. (DOK 2)
- Force exerted over a distance (results in work done)
 - Force-distance graph (to determine work)

- Network on an object that contributes to change in kinetic energy (work to energy theorem)
 - e. Describe (with supporting details and diagrams) how the kinetic energy of an object can be converted into potential energy (the energy of position) and how energy is transferred or transformed (conservation of energy). (DOK 2)
 - d. Draw and assess conclusions about charges and electric current. (DOK 2)
 - Static/current electricity and direct current/alternating current
 - Elements in an electric circuit that are in series or parallel
 - Conductors and insulators
 - Relationship between current flowing through a resistor and voltage flowing across a resistor
 - e. Cite evidence and explain the application of electric currents and magnetic fields as they relate to their use in everyday living (e.g., the application of fields in motors and generators and the concept of electric current using Ohm's law). (DOK 2)
- 3. Demonstrate an understanding of general properties and characteristics of waves.**
- a. Differentiate among transverse, longitudinal, and surface waves as they propagate through a medium (e.g., string, air, water, steel beam). (DOK 1)
 - b. Compare properties of waves (e.g., superposition, interference, refraction, reflection, diffraction, Doppler effect), and explain the connection among the quantities (e.g., wavelength, frequency, period, amplitude, and velocity). (DOK 2)
 - c. Classify the electromagnetic spectrum's regions according to frequency and/or wavelength, and draw conclusions about their impact on life. (DOK 2)
 - The emission of light by electrons when moving from higher to lower levels
 - Energy (photons as quanta of light)
 - Additive and subtractive properties of colors
 - Relationship of visible light to the color spectrum
 - d. Explain how sound intensity is measured and its relationship to the decibel scale. (DOK 1)
- 4. Develop an understanding of the atom.**
- a. Cite evidence to summarize the atomic theory. (DOK 1)
 - Models for atoms
 - Hund's rule and Aufbau process to specify the electron configuration of elements
 - Building blocks of matter (e.g., proton, neutron, and electron) and elementary particles (e.g., positron, mesons, neutrinos, etc.)
 - Atomic orbitals (s, p, d, f) and their basic shapes
 - b. Explain the difference between chemical and physical changes, and demonstrate how these changes can be used to separate mixtures and compounds into their components. (DOK 2)
 - c. Research the history of the periodic table of the elements, and summarize the contributions that led to the atomic theory. (DOK 2)
 - Contributions of scientists (e.g., John Dalton, J.J. Thomson, Ernest Rutherford, Newton, Einstein, Neils Bohr, Louis de Broglie, Erwin Schrödinger, etc.)
 - Technology (e.g., X-rays, cathode ray tubes, spectroscopes)
 - Experiments (e.g., gold foil, cathode ray, etc.)

- d. Utilize the periodic table to predict and explain patterns and draw conclusions about the structure, properties, and organization of matter. (DOK 2)
 - Atomic composition and valence electron configuration (e.g., atomic number, mass number of protons, neutrons, electrons, isotopes, and ions)
 - Periodic trends using the periodic table (e.g., valence, reactivity, atomic radius)
 - Average atomic mass from isotopic abundance
 - Solids, liquids, and gases
 - Periodic properties of elements (e.g., metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity, electron affinity, ionization energy, atomic/covalent/ionic radius) and how they relate to position in the periodic table

5. Investigate and apply principles of physical and chemical changes in matter.

- a. Write chemical formulas for compounds comprising monatomic and polyatomic ions. (DOK 1)
- b. Balance chemical equations. (DOK 2)
- c. Classify types of chemical reactions (e.g., composition, decomposition, single displacement, double displacement, combustion, acid/base reactions). (DOK 2)

Physics I

PHYI 1 — Apply inquiry-based and problem-solving processes and skills to scientific investigations.

PHYI 2 — Develop an understanding of concepts related to forces and motion.

PHYI 3 — Develop an understanding of concepts related to work and energy.

PHYI 4 — Discuss the characteristics and properties of light and sound.

PHYI 5 — Apply an understanding of magnetism, electric fields, and electricity.

PHYI 6 — Analyze and explain concepts of nuclear physics.

1. Investigate and apply principles of physical and chemical changes in matter.

- a. Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)
- b. Clarify research questions, and design laboratory investigations. (DOK 3)
- c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
- d. Organize data to construct graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
- e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
- f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
- g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.). (DOK 3)

2. Develop an understanding of concepts related to forces and motion.

- a. Use inquiry to investigate and develop an understanding of the kinematics and dynamics of physical bodies. (DOK 3)
 - Vector and scalar quantities
 - Vector problems (solved mathematically and graphically)
 - Vector techniques and free body diagrams to determine the net force on a body when several forces are acting on it
 - Relations among mass, inertia, and weight
 - b. Analyze, describe, and solve problems by creating and utilizing graphs of one-dimensional motion (e.g., position, distance, displacement, time, speed, velocity, acceleration, the special case of free fall). (DOK 2)
 - c. Analyze real world applications to draw conclusions about Newton's three laws of motion. (DOK 2)
 - d. Apply the effects of the universal gravitation law to graph and interpret the force between two masses, acceleration due to gravity, and planetary motion. (DOK 2)
 - Situations where g is constant (falling bodies)
 - Concept of centripetal acceleration undergoing uniform circular motion
 - Kepler's third law
 - Oscillatory motion and the mechanics of waves
- 3. Develop an understanding of concepts related to work and energy.**
- a. Explain and apply the conservation of energy and momentum. (DOK 2)
 - Concept of work and applications
 - Concept of kinetic energy, using the elementary work-energy theorem
 - Concept of conservation of energy with simple examples
 - Concepts of energy, work, and power (qualitatively and quantitatively)
 - Principles of impulse in inelastic and elastic collisions
 - b. Analyze real world applications to draw conclusions about mechanical potential energy (the energy of configuration). (DOK 3)
 - c. Apply the principles of impulse, and compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions. (DOK 1)
 - d. Investigate and summarize the principles of thermodynamics. (DOK 2)
 - How heat energy is transferred from higher temperature to lower temperature until equilibrium is reached
 - Temperature and thermal energy as related to molecular motion and states of matter
 - Problems involving specific heat and heat capacity
 - First and second laws of thermodynamics as related to heat engines, refrigerators, and thermal efficiency
 - e. Develop the kinetic theory of ideal gases and explain the concept of Carnot efficiency. (DOK 2)
- 4. Discuss the characteristics and properties of light and sound.**
- a. Describe and model the characteristics and properties of mechanical waves. (DOK 2)
 - Simple harmonic motion
 - Relationships among wave characteristics such as velocity, period, frequency, amplitude, phase, and wavelength
 - Energy of a wave in terms of amplitude and frequency.

- Standing waves and waves in specific media (e.g., stretched string, water surface, air, etc.)
 - b. Differentiate and explain the Doppler effect as it relates to a moving source and to a moving observer. (DOK 1)
 - c. Explain the laws of reflection and refraction, and apply Snell's law to describe the relationship between the angles of incidence and refraction. (DOK 2)
 - d. Use ray tracing and the thin lens equation to solve real-world problems involving object distance from lenses. (DOK 2)
 - e. Investigate and draw conclusions about the characteristics and properties of electromagnetic waves. (DOK 2)
- 5. Apply an understanding of magnetism, electric fields, and electricity.**
- a. Analyze and explain the relationship between electricity and magnetism. (DOK 2)
 - Characteristics of static charge and how a static charge is generated
 - Electric field, electric potential, current, voltage, and resistance as related to Ohm's law
 - Magnetic poles, magnetic flux and field, Ampère's law and Faraday's law
 - Coulomb's law
 - b. Use schematic diagrams to analyze the current flow in series and parallel electric circuits, given the component resistances and the imposed electric potential. (DOK 2)
 - c. Analyze and explain the relationship between magnetic fields and electrical current by induction, generators, and electric motors. (DOK 2)
- 6. Analyze and explain concepts of nuclear physics.**
- a. Analyze and explain the principles of nuclear physics. (DOK 1)
 - The mass number and atomic number of the nucleus of an isotope of a given chemical element
 - The conservation of mass and the conservation of charge
 - Nuclear decay
 - b. Defend the wave-particle duality model of light, using observational evidence. (DOK 3)
 - Quantum energy and emission spectra
 - Photoelectric and Compton effects

Spatial Information Science

SP 1 Apply inquiry-based and problem-solving processes and skills to scientific investigations.

SP 2 Develop an understanding of geographic information systems.

1. Demonstrate the basic concepts of global positioning systems (GPS). (E)

- a. Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)
- b. Clarify research questions, and design laboratory investigations. (DOK 3)
- c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, and theory development). (DOK 3)

- d. Organize data to construct graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences). (DOK 3)
- e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
- f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
- g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBLs, etc.). (DOK 3)

2. Demonstrate the basic concepts of remote sensing. (E, P)

- a. Describe the characteristics of the electromagnetic spectrum.
- b. Using images and graphs, interpret the absorption/reflection spectrum.
- c. Distinguish between passive vs. active sensor systems.
- d. Analyze the effects of changes in spatial, temporal, and spectral resolution.
- e. Analyze the effects on images due to changes in scale.
- f. Identify the types of sensor platforms.

Zoology

- ZO 1 Apply inquiry based and problem solving processes and skills to scientific investigations.
- ZO 2 Develop an understanding of levels of organization and animal classification.
- ZO 3 Differentiate among animal life cycles, behaviors, adaptations, and relationships.
- ZO 4 Demonstrate an understanding of the principles of animal genetic diversity and evolution.

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
 - Safety rules and symbols
 - Proper use and care of the compound light microscope, slides, chemicals, etc.
 - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
- b. Formulate questions that can be answered through research and experimental design. (DOK 3)
- c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
- d. Construct and analyze graphs (e.g., plotting points, labeling x and y axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
- e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)

- f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
- g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

2. Develop an understanding of levels of organization and animal classification.

- a. Explain how organisms are classified, and identify characteristics of major groups. (DOK 1)
 - Levels of organization of structures in animals (e.g., cells, tissues, organs, and systems)
 - Characteristics used to classify organisms (e.g., cell structure, biochemistry, anatomy, fossil record, and methods of reproduction)
- b. Identify and describe characteristics of the major phyla. (DOK 1)
 - Symmetry and body plan
 - Germ layers and embryonic development
 - Organ systems (e.g., digestive, circulatory, excretory, and reproductive)
 - Locomotion and coordination
- c. Distinguish viruses from bacteria and protists, and give examples. (DOK 1)
- d. Differentiate among the characteristics of bacteria, archaea, and eucarya. (DOK 1)
 - Phylogenic sequencing of the major phyla
 - Invertebrate characteristics (e.g., habitat, reproduction, body plan, locomotion) of the following phyla: Porifera, Cnidarians, Nematoda, Annelida, Platyhelminthes, Arthropoda, Insecta, Crustacea, Arachnida, Mollusca [Bivalvia and Gastropoda], and Echinodermata)
 - Vertebrate characteristics (e.g., habitat, reproduction, body plan, locomotion) of the following classes: Agnatha, Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves, and Mammalia

3. Differentiate among animal life cycles, behaviors, adaptations, and relationships.

- a. Describe life cycles, alternation of generations, and metamorphosis of various animals, and evaluate the advantages and disadvantages of asexual and sexual reproduction. (DOK 1)
- b. Describe and explain concepts of animal behavior, and differentiate between learned and innate behavior. (DOK 1)
 - Division of labor within a group of animals
 - Communication within animals groups
 - Degree of parental care given in animal groups
- c. Evaluate the unique protective adaptations of animals as they relate to survival. (DOK 2)
- d. Compare and contrast ecological relationships, and make predictions about the survival of populations under given circumstances. (DOK 3)
 - Terrestrial and aquatic ecosystems
 - Herbivores, carnivores, omnivores, decomposers and other feeding relationships
 - Symbiotic relationships such as mutualism, commensalisms, and parasitism
- e. Contrast food chains and food webs. (DOK 2)

4. Demonstrate an understanding of the principles of animal genetic diversity and evolution.

- a. ~~Categorize and explain sources of genetic variation on the cellular level (e.g., mutations, crossing over, and nondisjunction) and the population level (e.g., nonrandom mating, migration, etc.). (DOK 2)~~
- ~~• Relationship between natural selection and evolution~~
 - ~~• Mutations, crossing over, nondisjunction~~
 - ~~• Nonrandom mating, migration, etc.~~
 - ~~• Effects of genetic drift on evolution~~
- b. ~~Develop a logical argument defending or refuting issues related to genetic engineering of animals. (DOK 3)~~

Appendix C: ACT College Readiness Standards

English

E1 Topic Development in Terms of Purpose and Focus

- Identify the basic purpose or role of a specified phrase or sentence.
- Delete a clause or sentence because it is obviously irrelevant to the essay.
- Identify the central idea or main topic of a straightforward piece of writing.
- Determine relevancy when presented with a variety of sentence-level details.
- Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens that focus or to determine if an essay has met a specified goal.
- Delete material primarily because it disturbs the flow and development of the paragraph.
- Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement.
- Apply an awareness of the focus and purpose of a fairly involved essay to determine the rhetorical effect and suitability of an existing phrase or sentence or to determine the need to delete plausible but irrelevant material.
- Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add supporting detail, or to express meaning through connotation.
- Determine whether a complex essay has accomplished a specific purpose.
- Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus of the essay.

E2 Organization, Unity, and Coherence

- Use conjunctive adverbs or phrases to show time relationship in simple narrative essays (e.g., *then*, *this time*, etc.).
- Select the most logical place to add a sentence in a paragraph.
- Use conjunctive adverbs or phrases to express straightforward logical relationships (e.g., *first*, *afterward*, *in response*).
- Decide the most logical place to add a sentence in an essay.
- Add a sentence that introduces a simple paragraph.
- Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., *therefore*, *however*, *in addition*).
- Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic.
- Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward.
- Make sophisticated distinctions concerning the logical use of conjunctive adverbs or phrases, particularly when signaling a shift between paragraphs.
- Rearrange sentences to improve the logic and coherence of a complex paragraph.
- Add a sentence to introduce or conclude a fairly complex paragraph.
- Consider the need for introductory sentences or transitions, basing decisions on a thorough understanding of both the logic and rhetorical effect of the paragraph and essay.

E3 Word Choice in Terms of Style, Tone, Clarity, and Economy

- ~~Revise sentences to correct awkward and confusing arrangements of sentence elements.~~
- ~~Revise vague nouns and pronouns that create obvious logic problems.~~
- ~~Delete obviously synonymous and wordy material in a sentence.~~
- ~~Revise expressions that deviate from the style of an essay.~~
- ~~Delete redundant material when information is repeated in different parts of speech (e.g., *alarmingly startled*).~~
- ~~Use the word or phrase most consistent with the style and tone of a fairly straightforward essay.~~
- ~~Determine the clearest and most logical conjunction to link clauses.~~
- ~~Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence.~~
- ~~Identify and correct ambiguous pronoun references.~~
- ~~Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay.~~
- ~~Correct redundant material that involves sophisticated vocabulary and sounds acceptable as conversational English (e.g., *an aesthetic viewpoint* versus *the outlook of an aesthetic viewpoint*).~~
- ~~Correct vague and wordy or clumsy and confusing writing containing sophisticated language.~~
- ~~Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole.~~

E4 Sentence Structure and Formation

- ~~Use conjunctions or punctuation to join simple clauses.~~
- ~~Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences.~~
- ~~Determine the need for punctuation and conjunctions to avoid awkward sounding sentence fragments and fused sentences.~~
- ~~Decide the appropriate verb tense and voice by considering the meaning of the entire sentence.~~
- ~~Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, dangling or misplaced modifiers).~~
- ~~Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems.~~
- ~~Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence.~~
- ~~Use sentence combining techniques, effectively avoiding problematic comma splices, run-on sentences, and sentence fragments, especially in sentences containing compound subjects or verbs.~~
- ~~Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole.~~

- ~~Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses.~~

E5 Conventions of Usage

- ~~Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives.~~
- ~~Solve such grammatical problems as whether to use an adverb or adjective form, how to ensure straightforward subject-verb and pronoun-antecedent agreement, and which preposition to use in simple contexts.~~
- ~~Recognize and use the appropriate word in frequently confused pairs such as *there* and *their*, *past* and *passed*, and *led* and *lead*.~~
- ~~Use idiomatically appropriate prepositions, especially in combination with verbs (e.g., *long for*, *appeal to*).~~
- ~~Ensure that a verb agrees with its subject when there is some text between the two.~~
- ~~Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences.~~
- ~~Identify the correct past and past participle forms of irregular and infrequently used verbs, and form present perfect verbs by using *have* rather than *of*.~~
- ~~Correctly use reflexive pronouns, the possessive pronouns *its* and *your*, and the relative pronouns *who* and *whom*.~~
- ~~Ensure that a verb agrees with its subject in unusual situations (e.g., when the subject-verb order is inverted or when the subject is an indefinite pronoun).~~
- ~~Provide idiomatically and contextually appropriate prepositions following verbs in situations involving sophisticated language or ideas.~~
- ~~Ensure that a verb agrees with its subject when a phrase or clause between the two suggests a different number for the verb.~~

E6 Conventions of Punctuation

- ~~Delete commas that create basic sense problems (e.g., between verb and direct object).~~
- ~~Provide appropriate punctuation in straightforward situations (e.g., items in a series).~~
- ~~Delete commas that disturb the sentence flow (e.g., between modifier and modified element).~~
- ~~Use commas to set off simple parenthetical phrases.~~
- ~~Delete unnecessary commas when an incorrect reading of the sentence suggests a pause that should be punctuated (e.g., between verb and direct object clause).~~
- ~~Use punctuation to set off complex parenthetical phrases.~~
- ~~Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by *and*).~~
- ~~Use apostrophes to indicate simple possessive nouns.~~
- ~~Recognize inappropriate uses of colons and semicolons.~~

- Use commas to set off a nonessential/nonrestrictive appositive or clause.
- Deal with multiple punctuation problems (e.g., compound sentences containing unnecessary commas and phrases that may or may not be parenthetical).
- Use an apostrophe to show possession, especially with irregular plural nouns.
- Use a semicolon to indicate a relationship between closely related independent clauses.
- Use a colon to introduce an example or an elaboration.

Math

M1 Basic Operations and Applications

- Perform one operation computation with whole numbers and decimals.
- Solve problems in one or two steps using whole numbers.
- Perform common conversions (e.g., inches to feet or hours to minutes).
- Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent.
- Solve some routine two-step arithmetic problems.
- Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average.
- Solve multistep arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour).
- Solve word problems containing several rates, proportions, or percentages.
- Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre-algebra and/or pre-geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings).

M2 Probability, Statistics, and Data Analysis

- Calculate the average of a list of positive whole numbers.
- Perform a single computation using information from a table or chart.
- Calculate the average of a list of numbers.
- Calculate the average, given the number of data values and the sum of the data values.
- Read tables and graphs.
- Perform computations on data from tables and graphs.
- Use the relationship between the probability of an event and the probability of its complement.
- Calculate the missing data value, given the average and all data values but one.
- Translate from one representation of data to another (e.g., a bar graph to a circle graph).
- Determine the probability of a simple event.
- Exhibit knowledge of simple counting techniques.*
- Calculate the average, given the frequency counts of all the data values.
- Manipulate data from tables and graphs.
- Compute straightforward probabilities for common situations.
- Use Venn diagrams in counting.*

- Calculate or use a weighted average.
- Interpret and use information from figures, tables, and graphs.
- Apply counting techniques.
- Compute a probability when the event and/or sample space is not given or obvious.
- Distinguish between mean, median, and mode for a list of numbers.
- Analyze and draw conclusions based on information from figures, tables, and graphs.
- Exhibit knowledge of conditional and joint probability.

M3 Numbers: Concepts and Properties

- Recognize equivalent fractions and fractions in lowest terms.
- Recognize one-digit factors of a number.
- Identify a digit's place value.
- Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor.
- Find and use the least common multiple.
- Order fractions.
- Work with numerical factors.
- Work with scientific notation.
- Work with squares and square roots of numbers.
- Work problems involving positive integer exponents.*
- Work with cubes and cube roots of numbers.*
- Determine when an expression is undefined.*
- Exhibit some knowledge of the complex numbers.†
- Apply number properties involving prime factorization.
- Apply number properties involving even and odd numbers and factors and multiples.
- Apply number properties involving positive and negative numbers.
- Apply rules of exponents.
- Multiply two complex numbers.†
- Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers.
- Exhibit knowledge of logarithms and geometric sequences.
- Apply properties of complex numbers.

M4 Expressions, Equations, and Inequalities

- Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$).
- Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals.
- Substitute whole numbers for unknown quantities to evaluate expressions.
- Solve one-step equations having integer or decimal answers.
- Combine like terms (e.g., $2x + 5x$).
- Evaluate algebraic expressions by substituting integers for unknown quantities.
- Add and subtract simple algebraic expressions.
- Solve routine first-degree equations.
- Perform straightforward word-to-symbol translations.

- ~~Multiply two binomials.*~~
- ~~Solve real-world problems using first-degree equations.~~
- ~~Write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions).~~
- ~~Identify solutions to simple quadratic equations.~~
- ~~Add, subtract, and multiply polynomials.*~~
- ~~Factor simple quadratics (e.g., the difference of squares and perfect square trinomials).*~~
- ~~Solve first-degree inequalities that do not require reversing the inequality sign.*~~
- ~~Manipulate expressions and equations.~~
- ~~Write expressions, equations, and inequalities for common algebra settings.~~
- ~~Solve linear inequalities that require reversing the inequality sign.~~
- ~~Solve absolute value equations.~~
- ~~Solve quadratic equations.~~
- ~~Find solutions to systems of linear equations.~~
- ~~Write expressions that require planning and/or manipulating to accurately model a situation.~~
- ~~Write equations and inequalities that require planning, manipulating, and/or solving.~~
- ~~Solve simple absolute value inequalities.~~

M5 Graphical Representations

- ~~Identify the location of a point with a positive coordinate on the number line.~~
- ~~Locate points on the number line and in the first quadrant.~~
- ~~Locate points in the coordinate plane.~~
- ~~Comprehend the concept of length on the number line.*~~
- ~~Exhibit knowledge of slope.*~~
- ~~Identify the graph of a linear inequality on the number line.*~~
- ~~Determine the slope of a line from points or equations.*~~
- ~~Match linear graphs with their equations.*~~
- ~~Find the midpoint of a line segment.*~~
- ~~Interpret and use information from graphs in the coordinate plane.~~
- ~~Match number line graphs with solution sets of linear inequalities.~~
- ~~Use the distance formula.~~
- ~~Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point.~~
- ~~Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle).†~~
- ~~Match number line graphs with solution sets of simple quadratic inequalities.~~
- ~~Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$.~~
- ~~Solve problems integrating multiple algebraic and/or geometric concepts.~~
- ~~Analyze and draw conclusions based on information from graphs in the coordinate plane.~~

M6 Properties of Plane Figures

- Exhibit some knowledge of the angles associated with parallel lines.
- Find the measure of an angle using properties of parallel lines.
- Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90° , 180° , and 360°).
- Use several angle properties to find an unknown angle measure.
- Recognize Pythagorean triples.*
- Use properties of isosceles triangles.*
- Apply properties of 30° - 60° - 90° , 45° - 45° - 90° , similar, and congruent triangles.
- Use the Pythagorean theorem.
- Draw conclusions based on a set of conditions.
- Solve multistep geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas.
- Use relationships among angles, arcs, and distances in a circle.

M7 Measurement

- Estimate or calculate the length of a line segment based on other lengths given on a geometric figure.
- Compute the perimeter of polygons when all side lengths are given.
- Compute the area of rectangles when whole number dimensions are given.
- Compute the area and perimeter of triangles and rectangles in simple problems.
- Use geometric formulas when all necessary information is given.
- Compute the area of triangles and rectangles when one or more additional simple steps are required.
- Compute the area and circumference of circles after identifying necessary information.
- Compute the perimeter of simple composite geometric figures with unknown side lengths.*
- Use relationships involving area, perimeter, and volume of geometric figures to compute another measure.
- Use scale factors to determine the magnitude of a size change.
- Compute the area of composite geometric figures when planning or visualization is required.

M8 Functions

- Evaluate quadratic functions, expressed in function notation, at integer values.
- Evaluate polynomial functions, expressed in function notation, at integer values.†
- Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths.†
- Evaluate composite functions at integer values.†
- Apply basic trigonometric ratios to solve right triangle problems.†
- Write an expression for the composite of two simple functions.†
- Use trigonometric concepts and basic identities to solve problems.†
- Exhibit knowledge of unit circle trigonometry.†

- ~~Match graphs of basic trigonometric functions with their equations.~~

Notes

- ~~Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.~~
- ~~Standards followed by an asterisk (*) apply to the PLAN and ACT Mathematics tests only.~~
- ~~Standards followed by a dagger (†) apply to the ACT Mathematics test only.~~

Reading

R1 Main Ideas and Author's Approach

- ~~Recognize a clear intent of an author or narrator in uncomplicated literary narratives.~~
- ~~Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.~~
- ~~Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.~~
- ~~Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in uncomplicated passages.~~
- ~~Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages.~~
- ~~Infer the main idea or purpose of straightforward paragraphs in more challenging passages.~~
- ~~Summarize basic events and ideas in more challenging passages.~~
- ~~Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in more challenging passages.~~
- ~~Infer the main idea or purpose of more challenging passages or their paragraphs.~~
- ~~Summarize events and ideas in virtually any passage.~~
- ~~Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in virtually any passage.~~
- ~~Identify clear main ideas or purposes of complex passages or their paragraphs.~~

R2 Supporting Details

- ~~Locate basic facts (e.g., names, dates, events) clearly stated in a passage.~~
- ~~Locate simple details at the sentence and paragraph level in uncomplicated passages.~~
- ~~Recognize a clear function of a part of an uncomplicated passage.~~
- ~~Locate important details in uncomplicated passages.~~
- ~~Make simple inferences about how details are used in passages.~~
- ~~Locate important details in more challenging passages.~~
- ~~Locate and interpret minor or subtly stated details in uncomplicated passages.~~
- ~~Discern which details, though they may appear in different sections throughout a passage, support important points in more challenging passages.~~
- ~~Locate and interpret minor or subtly stated details in more challenging passages.~~

- Use details from different sections of some complex informational passages to support a specific point or argument.
- Locate and interpret details in complex passages.
- Understand the function of a part of a passage when the function is subtle or complex.

R3 Sequential, Comparative, and Cause-Effect Relationships

- Determine when (e.g., first, last, before, after) or if an event occurred in uncomplicated passages.
- Recognize clear cause-effect relationships described within a single sentence in a passage.
- Identify relationships between main characters in uncomplicated literary narratives.
- Recognize clear cause-effect relationships within a single paragraph in uncomplicated literary narratives.
- Order simple sequences of events in uncomplicated literary narratives.
- Identify clear relationships between people, ideas, and so forth in uncomplicated passages.
- Identify clear cause-effect relationships in uncomplicated passages.
- Order sequences of events in uncomplicated passages.
- Understand relationships between people, ideas, and so forth in uncomplicated passages.
- Identify clear relationships between characters, ideas, and so forth in more challenging literary narratives.
- Understand implied or subtly stated cause-effect relationships in uncomplicated passages.
- Identify clear cause-effect relationships in more challenging passages.
- Order sequences of events in more challenging passages.
- Understand the dynamics between people, ideas, and so forth in more challenging passages.
- Understand implied or subtly stated cause-effect relationships in more challenging passages.
- Order sequences of events in complex passages.
- Understand the subtleties in relationships between people, ideas, and so forth in virtually any passage.
- Understand implied, subtle, or complex cause-effect relationships in virtually any passage.

R4 Meaning of Words

- Understand the implication of a familiar word or phrase and of simple descriptive language.
- Use context to understand basic figurative language.
- Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in uncomplicated passages.
- Use context to determine the appropriate meaning of virtually any word, phrase, or statement in uncomplicated passages.

- Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more challenging passages.
- Determine the appropriate meaning of words, phrases, or statements from figurative or somewhat technical contexts.
- Determine, even when the language is richly figurative and the vocabulary is difficult, the appropriate meaning of context-dependent words, phrases, or statements in virtually any passage.

R5 Generalizations and Conclusions

- Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives.
- Draw simple generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.
- Draw generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.
- Draw simple generalizations and conclusions using details that support the main points of more challenging passages.
- Draw subtle generalizations and conclusions about characters, ideas, and so forth in uncomplicated literary narratives.
- Draw generalizations and conclusions about people, ideas, and so forth in more challenging passages.
- Use information from one or more sections of a more challenging passage to draw generalizations and conclusions about people, ideas, and so forth.
- Draw complex or subtle generalizations and conclusions about people, ideas, and so forth, often by synthesizing information from different portions of the passage.
- Understand and generalize about portions of a complex literary narrative.

Science

S1 Interpretation of Data

- Select a single piece of data (numerical or non-numerical) from a simple data presentation (e.g., a table or graph with two or three variables, a food web diagram).
- Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels).
- Select two or more pieces of data from a simple data presentation.
- Understand basic scientific terminology.
- Find basic information in a brief body of text.
- Determine how the value of one variable changes as the value of another variable changes in a simple data presentation.
- Select data from a complex data presentation (e.g., a table or graph with more than three variables, a phase diagram).
- Compare or combine data from a simple data presentation (e.g., order or sum data from a table).
- Translate information into a table, graph, or diagram.

- ~~Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table).~~
- ~~Compare or combine data from a complex data presentation.~~
- ~~Interpolate between data points in a table or graph.~~
- ~~Determine how the value of one variable changes as the value of another variable changes in a complex data presentation.~~
- ~~Identify and/or use a simple (e.g., linear) mathematical relationship between data.~~
- ~~Analyze given information when presented with new, simple information.~~
- ~~Compare or combine data from a simple data presentation with data from a complex data presentation.~~
- ~~Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data.~~
- ~~Extrapolate from data points in a table or graph.~~
- ~~Compare or combine data from two or more complex data presentations.~~
- ~~Analyze given information when presented with new, complex information.~~

S2 Scientific Investigation

- ~~Understand the methods and tools used in a simple experiment.~~
- ~~Understand the methods and tools used in a moderately complex experiment.~~
- ~~Understand a simple experimental design.~~
- ~~Identify a control in an experiment.~~
- ~~Identify similarities and differences between experiments.~~
- ~~Understand the methods and tools used in a complex experiment.~~
- ~~Understand a complex experimental design.~~
- ~~Predict the results of an additional trial or measurement in an experiment.~~
- ~~Determine the experimental conditions that would produce specified results.~~
- ~~Determine the hypothesis for an experiment.~~
- ~~Identify an alternate method for testing a hypothesis.~~
- ~~Understand precision and accuracy issues.~~
- ~~Predict how modifying the design or methods of an experiment will affect results.~~
- ~~Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results.~~

S3 Evaluation of Models, Inferences, and Experimental Results

- ~~Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model.~~
- ~~Identify key issues or assumptions in a model.~~
- ~~Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.~~
- ~~Determine whether given information supports or contradicts a simple hypothesis or conclusion and why.~~
- ~~Identify strengths and weaknesses in one or more models.~~
- ~~Identify similarities and differences between models.~~
- ~~Determine which model(s) is/are supported or weakened by new information.~~

- Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion.
- Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model.
- Determine whether new information supports or weakens a model and why.
- Use new information to make a prediction based on a model.
- Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.
- Determine whether given information supports or contradicts a complex hypothesis or conclusion and why.

Writing

W1—Expressing Judgments

- Show a little understanding of the persuasive purpose of the task, but neglect to take or to maintain a position on the issue in the prompt.
- Show limited recognition of the complexity of the issue in the prompt.
- Show a basic understanding of the persuasive purpose of the task by taking a position on the issue in the prompt but may not maintain that position.
- Show a little recognition of the complexity of the issue in the prompt by acknowledging, but only briefly describing, a counterargument to the writer’s position.
- Show understanding of the persuasive purpose of the task by taking a position on the issue in the prompt.
- Show some recognition of the complexity of the issue in the prompt by doing the following:
 - Acknowledging counterarguments to the writer’s position
 - Providing some response to counterarguments to the writer’s position
- Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a broad context for discussion.
- Show recognition of the complexity of the issue in the prompt by doing the following:
 - Partially evaluating implications and/or complications of the issue
 - Posing and partially responding to counterarguments to the writer’s position
- Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a critical context for discussion.
- Show understanding of the complexity of the issue in the prompt by doing the following:
 - Examining different perspectives
 - Evaluating implications or complications of the issue
 - Posing and fully discussing counterarguments to the writer’s position

W2 Focusing on the Topic

- Maintain a focus on the general topic in the prompt through most of the essay.
- Maintain a focus on the general topic in the prompt throughout the essay.
- Maintain a focus on the general topic in the prompt throughout the essay, and attempt a focus on the specific issue in the prompt.

- ~~Present a thesis that establishes focus on the topic.~~
- ~~Maintain a focus on discussion of the specific topic and issue in the prompt throughout the essay.~~
- ~~Present a thesis that establishes a focus on the writer's position on the issue.~~
- ~~Maintain a clear focus on discussion of the specific topic and issue in the prompt throughout the essay.~~
- ~~Present a critical thesis that clearly establishes the focus on the writer's position on the issue.~~

W3—Developing a Position

- ~~Offer a little development, with one or two ideas; if examples are given, they are general and may not be clearly relevant; resort often to merely repeating ideas.~~
- ~~Show little or no movement between general and specific ideas and examples.~~
- ~~Offer limited development of ideas using a few general examples; resort sometimes to merely repeating ideas.~~
- ~~Show little movement between general and specific ideas and examples.~~
- ~~Develop ideas by using some specific reasons, details, and examples.~~
- ~~Show some movement between general and specific ideas and examples.~~
- ~~Develop most ideas fully, using some specific and relevant reasons, details, and examples.~~
- ~~Show clear movement between general and specific ideas and examples.~~
- ~~Develop several ideas fully, using specific and relevant reasons, details, and examples.~~
- ~~Show effective movement between general and specific ideas and examples.~~

W4—Organizing Ideas

- ~~Provide a discernible organization with some logical grouping of ideas in parts of the essay.~~
- ~~Use a few simple and obvious transitions.~~
- ~~Present a discernible, though minimally developed, introduction and conclusion.~~
- ~~Provide a simple organization with logical grouping of ideas in parts of the essay.~~
- ~~Use some simple and obvious transitional words, though they may at times be inappropriate or misleading.~~
- ~~Present a discernible, though underdeveloped, introduction and conclusion.~~
- ~~Provide an adequate but simple organization with logical grouping of ideas in parts of the essay but with little evidence of logical progression of ideas.~~
- ~~Use some simple and obvious, but appropriate, transitional words and phrases.~~
- ~~Present a discernible introduction and conclusion with a little development.~~
- ~~Provide unity and coherence throughout the essay, sometimes with a logical progression of ideas.~~
- ~~Use relevant, though at times simple and obvious, transitional words and phrases to convey logical relationships between ideas.~~
- ~~Present a somewhat developed introduction and conclusion.~~

- Provide unity and coherence throughout the essay, often with a logical progression of ideas.
- Use relevant transitional words, phrases, and sentences to convey logical relationships between ideas.
- Present a well-developed introduction and conclusion.

W5 Using Language

- Show limited control of language by doing the following:
 - Correctly employing some of the conventions of standard English grammar, usage, and mechanics but with distracting errors that sometimes significantly impede understanding
 - Using simple vocabulary
 - Using simple sentence structure
 - Correctly employing some of the conventions of standard English grammar, usage, and mechanics but with distracting errors that sometimes impede understanding
 - Using simple but appropriate vocabulary
 - Using a little sentence variety, though most sentences are simple in structure
 - Correctly employing many of the conventions of standard English grammar, usage, and mechanics but with some distracting errors that may occasionally impede understanding
 - Using appropriate vocabulary
 - Using some varied kinds of sentence structures to vary pace
 - Correctly employing most conventions of standard English grammar, usage, and mechanics with a few distracting errors but none that impede understanding
 - Using some precise and varied vocabulary
 - Using several kinds of sentence structures to vary pace and to support meaning
 - Correctly employing most conventions of standard English grammar, usage, and mechanics with just a few, if any, errors
 - Using precise and varied vocabulary
 - Using a variety of kinds of sentence structures to vary pace and to support meaning

Appendix D: Pathway Content Standards

AGRICULTURE, FOOD, AND NATURAL RESOURCES (AFNR) PATHWAY CONTENT STANDARDS AND PERFORMANCE ELEMENTS

The AFNR Pathway Content Standards and Performance Elements are adapted from *National Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards*. Reprinted with permission from the National Council for Agricultural Education, 1410 King Street, Suite 400, Alexandria, VA 22314. (800) 772-0939. Copyright © 2009. A complete copy of the National Standards can be downloaded from the Team Ag Ed Learning Center at <https://aged.learn.com>.

AGRIBUSINESS SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of principles and techniques for the development and management of agribusiness systems.

ABS.01. Utilize economic principles to establish and manage an AFNR enterprise.

ABS.01.01. Apply principles of capitalism in the business environment.

ABS.01.02. Apply principles of entrepreneurship in businesses.

ABS.02. Utilize appropriate management planning principles in AFNR business enterprises.

ABS.02.01. Compose and analyze a business plan for an enterprise.

ABS.02.02. Read, interpret, evaluate, and write a mission statement to guide business goals, objectives, and resource allocation.

ABS.02.03. Apply appropriate management skills to organize a business.

ABS.02.04. Recruit, train, and retain appropriate and productive human resources for business.

ABS.03. Utilize record keeping to accomplish AFNR business objectives while complying with laws and regulations.

ABS.03.01. Prepare and maintain all files needed to accomplish effective record keeping.

ABS.03.02. Implement appropriate inventory management practices.

ABS.04. Apply generally accepted accounting principles and skills to manage cash budgets, credit budgets, and credit for AFNR businesses.

ABS.04.01. Use accounting fundamentals to accomplish dependable bookkeeping and fiscal management.

ABS.05. Assess accomplishment of goals and objectives by an AFNR business.

ABS.05.01. Maintain and interpret financial information (income statements, balance sheets, inventory, purchase orders, accounts receivable, and cash flow analyses) for businesses.

~~ABS.06.— Use industry-accepted marketing practices to accomplish AFNR business objectives.~~

~~ABS.06.01. Conduct appropriate market and marketing research.~~

~~ABS.06.02. Develop a marketing plan.~~

~~ABS.06.03. Develop strategies for marketing plan implementation.~~

~~ABS.06.04. Develop specific tactics to market AFNR products and services.~~

~~ABS.07.— Create a production system plan.~~

~~ABS.07.01. Prepare a step-by-step production plan that identifies needed resources.~~

~~ABS.07.02. Develop a production and operational plan.~~

~~ABS.07.03. Utilize appropriate techniques to determine the most likely strengths, weaknesses, and inconsistencies in a business plan, and relate these to risk management strategies.~~

~~ABS.07.04. Manage risk and uncertainty.~~

~~ANIMAL SYSTEMS~~

~~Pathway Content Standard: The student will demonstrate competence in the application of scientific principles and practices to the production and management of animals.~~

~~AS.01.— Examine the components, historical development, global implications, and future trends of the animal systems industry.~~

~~AS.01.01.— Evaluate the development and implications of animal origin, domestication, and distribution.~~

~~AS.02.— Classify, evaluate, select, and manage animals based on anatomical and physiological characteristics.~~

~~AS.02.01.— Classify animals according to hierarchical taxonomy and agricultural use.~~

~~AS.02.02.— Apply principles of comparative anatomy and physiology to uses within various animal systems.~~

~~AS.02.03.— Select animals for specific purposes and maximum performance based on anatomy and physiology.~~

~~AS.03.— Provide for the proper health care of animals.~~

~~AS.03.01.— Prescribe and implement a prevention and treatment program for animal diseases, parasites, and other disorders.~~

~~AS.03.02.— Provide for the biosecurity of agricultural animals and production facilities.~~

~~AS.04.— Apply principles of animal nutrition to ensure the proper growth, development, reproduction, and economic production of animals.~~

~~AS.04.01.— Formulate feed rations to provide for the nutritional needs of animals.~~

~~AS.04.02.—Prescribe and administer animal feed additives and growth promotants in animal production.~~

~~**AS.05.—Evaluate and select animals based on scientific principles of animal production.**~~

~~AS.05.01.—Evaluate the male and female reproductive systems in selecting animals.~~

~~AS.05.02.—Evaluate animals for breeding readiness and soundness.~~

~~AS.05.03.—Apply scientific principles in the selection and breeding of animals.~~

~~**AS.06.—Prepare and implement animal handling procedures for the safety of animals, producers and consumers of animal products.**~~

~~AS.06.01.—Demonstrate safe animal handling and management techniques.~~

~~AS.06.02.—Implement procedures to ensure that animal products are safe.~~

~~**AS.07.—Select animal facilities and equipment that provide for the safe and efficient production, housing, and handling of animals.**~~

~~AS.07.01.—Design animal housing, equipment, and handling facilities for the major systems of animal production.~~

~~AS.07.02.—Comply with government regulations and safety standards for facilities used in animal production.~~

~~**AS.08.—Analyze environmental factors associated with animal production.**~~

~~AS.08.01.—Reduce the effects of animal production on the environment.~~

~~AS.08.02.—Evaluate the effects of environmental conditions on animals.~~

BIOTECHNOLOGY

Pathway Content Standard: The student will demonstrate competence in the application of scientific principles and techniques to biotechnology in agriculture.

~~**BS.01.—Recognize the historical, social, cultural, and potential applications of biotechnology.**~~

~~BS.01.01.—Distinguish major innovators, historical developments, and potential applications of biotechnology in agriculture.~~

~~BS.01.02.—Determine regulatory issues, and identify agencies associated with biotechnology.~~

~~BS.01.03.—Analyze the ethical, legal, social, and cultural issues relating to biotechnology.~~

~~**BS.02.—Demonstrate laboratory skills as applied to biotechnology.**~~

~~BS.02.01.—Maintain and interpret biotechnology laboratory records.~~

~~BS.02.02.—Operate biotechnology laboratory equipment according to standard procedures.~~

~~BS.02.03.—Demonstrate proper laboratory procedures using biological materials.~~

~~BS.02.04.—Safely manage biological materials, chemicals, and wastes used in the laboratory.~~

~~BS.02.05.—Perform microbiology, molecular biology, enzymology, and immunology procedures.~~

~~**BS.03.—Demonstrate the application of biotechnology to Agriculture, Food, and Natural Resources (AFNR).**~~

~~BS.03.01.—Evaluate the application of genetic engineering to improve products of AFNR systems.~~

~~BS.03.02.—Perform biotechnology processes used in AFNR systems.~~

~~BS.03.03.—Use biotechnology to monitor and evaluate procedures performed in AFNR systems.~~

~~**ENVIRONMENTAL SERVICE SYSTEMS**~~

~~Pathway Content Standard: The student will demonstrate competence in the application of scientific principles and techniques to the management of environmental service systems.~~

~~**ESS.01.—Use analytical procedures to plan and evaluate environmental service systems.**~~

~~ESS.01.01.—Analyze and interpret samples.~~

~~**ESS.02.—Assess the impact of policies and regulations on environmental service systems.**~~

~~ESS.02.01.—Interpret laws affecting environmental service systems.~~

~~**ESS.03.—Apply scientific principles to environmental service systems.**~~

~~ESS.03.01.—Apply meteorology principles to environmental service systems.~~

~~ESS.03.02.—Apply soil science principles to environmental service systems.~~

~~ESS.03.03.—Apply hydrology principles to environmental service systems.~~

~~ESS.03.04.—Apply best management techniques associated with the properties, classifications, and functions of wetlands.~~

~~ESS.03.05.—Apply chemistry principles to environmental service systems.~~

~~ESS.03.06.—Apply microbiology principles to environmental service systems.~~

~~**ESS.04.—Operate environmental service systems to manage a facility environment.**~~

~~ESS.04.01.—Use pollution control measures to maintain a safe facility environment.~~

~~ESS.04.02.—Manage safe disposal of all categories of solid waste.~~

~~ESS.04.03.—Apply the principles of public drinking water treatment operations to ensure safe water at a facility.~~

~~ESS.04.04.—Apply principles of wastewater treatment to manage wastewater disposal in keeping with rules and regulations.~~

~~ESS.04.05.—Manage hazardous materials to assure a safe facility and to comply with applicable regulations.~~

~~ESS.05.—Examine the relationships between energy sources and environmental service systems.~~

~~ESS.05.01.— Compare and contrast the impact of conventional and alternative energy sources on the environment.~~

~~ESS.06.—Use tools, equipment, machinery, and technology to accomplish tasks in environmental service systems.~~

~~ESS.06.01.— Use technological and mathematical tools to map land, facilities, and infrastructure.~~

~~ESS.06.02.— Maintain tools, equipment, and machinery in safe working order for tasks in environmental service systems.~~

~~FOOD PRODUCTS AND PROCESSING SYSTEMS~~

~~Pathway Content Standard: The student will demonstrate competence in the application of scientific principles, practices, and techniques in the processing, storage, and development of food products.~~

~~FPP.01.—Examine components of the food industry and historical development of food products and processing.~~

~~FPP.01.01.— Evaluate the significance and implications of changes and trends in the food products and processing industry.~~

~~FPP.01.02.— Work effectively with industry organizations, groups, and regulatory agencies affecting the food products and processing industry.~~

~~FPP.02.—Apply safety principles, recommended equipment, and facility management techniques to the food products and processing industry.~~

~~FPP.02.01.— Manage operational procedures, and create equipment and facility maintenance plans.~~

~~FPP.02.02.— Implement Hazard Analysis and Critical Control Point (HACCP) procedures to establish operating parameters.~~

~~FPP.02.03.— Apply safety and sanitation procedures in the handling, processing, and storing of food products.~~

~~FPP.02.04.— Demonstrate worker safety procedures with food product and processing equipment and facilities.~~

~~FPP.03.—Apply principles of science to the food products and processing industry.~~

~~FPP.03.01.— Apply principles of science to food processing to provide a safe, wholesome, and nutritious food supply.~~

~~FPP.04.—Select and process food products for storage, distribution, and consumption.~~

~~FPP.04.01.— Utilize harvesting, selection, and inspection techniques to obtain quality food products for processing.~~

~~FPP.04.02.— Evaluate, grade, and classify processed food products.~~

~~FPP.04.03. Process, preserve, package, and present food and food products for sale and distribution.~~

NATURAL RESOURCE SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of scientific principles and techniques to the management of natural resources.

~~**NRS.01. Explain interrelationships between natural resources and humans necessary to conduct management activities in natural environments.**~~

~~NRS.01.01. Apply knowledge of natural resource components to the management of natural resource systems.~~

~~NRS01.02. Classify natural resources.~~

~~**NRS.02. Apply scientific principles to natural resource management activities.**~~

~~NRS.02.01. Develop a safety plan for work with natural resources.~~

~~NRS.02.02. Demonstrate cartographic skills to aid in developing, implementing, and evaluating natural resource management plans.~~

~~NRS.02.03. Measure and survey natural resource status to obtain planning data.~~

~~NRS.02.04. Demonstrate natural resource enhancement techniques.~~

~~NRS.02.05. Interpret laws related to natural resource management and protection.~~

~~NRS.02.06. Apply ecological concepts and principles to natural resource systems.~~

~~**NRS.03. Apply knowledge of natural resources to production and processing industries.**~~

~~NRS.03.01. Produce, harvest, process, and use natural resource products.~~

~~**NRS.04. Demonstrate techniques used to protect natural resources.**~~

~~NRS.04.01. Manage fires in natural resource systems.~~

~~NRS.04.02. Diagnose plant and wildlife diseases, and follow protocol to prevent their spread.~~

~~NRS.04.03. Manage insect infestations of natural resources.~~

~~**NRS.05. Use effective methods and venues to communicate natural resource processes to the public.**~~

~~NRS.05.01. Communicate natural resource information to the public.~~

PLANT SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of scientific principles and techniques to the production and management of plants.

~~**PS.01. Apply knowledge of plant classification, plant anatomy, and plant physiology to the production and management of plants.**~~

~~PS.01.01. Classify agricultural plants according to taxonomy systems.~~

~~PS.01.02.—Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.~~

~~PS.01.03.—Apply knowledge of plant physiology and energy conversion to plant systems.~~

~~**PS.02.—Prepare and implement a plant management plan that addresses the influence of environmental factors, nutrients, and soil on plant growth.**~~

~~PS.02.01.—Determine the influence of environmental factors on plant growth.~~

~~PS.02.02.—Prepare growing media for use in plant systems.~~

~~PS.02.03.—Develop and implement a fertilization plan for specific plants or crops.~~

~~**PS.03.—Propagate, culture, and harvest plants.**~~

~~PS.03.01.—Demonstrate plant propagation techniques.~~

~~PS.03.02.—Develop and implement a plant management plan for crop production.~~

~~PS.03.03.—Develop and implement a plan for integrated pest management.~~

~~PS.03.04.—Apply principles and practices of sustainable agriculture to plant production.~~

~~PS.03.05.—Harvest, handle, and store crops.~~

~~**PS.04.—Employ elements of design to enhance an environment.**~~

~~PS.04.01.—Create designs using plants.~~

~~**POWER, STRUCTURAL AND TECHNICAL SYSTEMS**~~

~~Pathway Content Standard: The student will demonstrate competence in the application of principles and techniques for the development and management of power, structural, and technical systems.~~

~~**PST.01.—Use physical science principles and engineering applications with power, structural, and technical systems to solve problems and improve performance.**~~

~~PST.01.01.—Select energy sources in power generation appropriate to the situation.~~

~~PST.01.02.—Apply physical science laws and principles to identify, classify, and use lubricants.~~

~~PST.01.03.—Identify and use hand and power tools and equipment for service, construction, and fabrication.~~

~~**PST.02.—Design, operate, and maintain mechanical equipment, structures, biological systems, land treatment, power, and technology.**~~

~~PST.02.01.—Perform service routines to maintain power units and equipment.~~

~~PST.02.02.—Operate, service, and diagnose the condition of power units and equipment.~~

~~**PST.03.—Service and repair mechanical equipment and power systems.**~~

~~PST.03.01.—Troubleshoot and repair internal combustion engines.~~

~~PST.03.02. Utilize manufacturers' guidelines to service and repair the power transmission systems of equipment.~~

~~PST.03.03. Service and repair hydraulic and pneumatic systems.~~

~~PST.03.04. Troubleshoot and service electrical systems.~~

~~PST.03.05. Service vehicle heating and air conditioning systems.~~

~~PST.03.06. Service and repair steering, suspension, traction, and vehicle performance systems.———~~

~~PST.04. Plan, build and maintain agricultural structures.~~

~~PST.04.01. Create sketches and plans of agricultural structures.~~

~~PST.04.02. Apply structural plans, specifications, and building codes.~~

~~PST.04.03. Examine structural requirements for materials and procedures, and estimate construction cost.~~

~~PST.04.05. Follow architectural and mechanical plans to construct and/or repair equipment, buildings, and facilities.~~

~~PST.05. Apply technology principles in the use of agricultural technical systems.~~

~~PST.05.01. Use instruments and meters to test and monitor electrical and electronic processes.~~

~~PST.05.02. Prepare and/or use electrical drawings to design, install, and troubleshoot control systems.~~

~~PST.05.03. Use geospatial technologies in agricultural applications.~~

Appendix E: National Educational Technology Standards for Students

~~T1—Creativity and Innovation~~

~~T2—Communication and Collaboration~~

~~T3—Research and Information Fluency~~

~~T4—Critical Thinking, Problem Solving, and Decision Making~~

~~T5—Digital Citizenship~~

~~T6—Technology Operations and Concepts~~

~~T1—Creativity and Innovation~~

~~Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students do the following:~~

- ~~a.—Apply existing knowledge to generate new ideas, products, or processes.~~
- ~~b.—Create original works as a means of personal or group expression.~~
- ~~c.—Use models and simulations to explore complex systems and issues.~~
- ~~d.—Identify trends and forecast possibilities.~~

~~T2—Communication and Collaboration~~

~~Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students do the following:~~

- ~~a.—Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.~~
- ~~b.—Communicate information and ideas effectively to multiple audiences using a variety of media and formats.~~
- ~~c.—Develop cultural understanding and global awareness by engaging with learners of other cultures.~~
- ~~d.—Contribute to project teams to produce original works or solve problems.~~

~~T3—Research and Information Fluency~~

~~Students apply digital tools to gather, evaluate, and use information. Students do the following:~~

- ~~a.—Plan strategies to guide inquiry.~~
- ~~b.—Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.~~
- ~~c.—Evaluate and select information sources and digital tools based on the appropriateness to specific tasks.~~
- ~~d.—Process data and report results.~~

~~T4—Critical Thinking, Problem Solving, and Decision Making~~

~~Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students do the following:~~

- ~~a.—Identify and define authentic problems and significant questions for investigation.~~
- ~~b.—Plan and manage activities to develop a solution or complete a project.~~

- e. — ~~Collect and analyze data to identify solutions and/or make informed decisions.~~
- d. — ~~Use multiple processes and diverse perspectives to explore alternative solutions.~~

T5 — Digital Citizenship

~~Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students do the following:~~

- a. — ~~Advocate and practice safe, legal, and responsible use of information and technology.~~
- b. — ~~Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.~~
- c. — ~~Demonstrate personal responsibility for lifelong learning.~~
- d. — ~~Exhibit leadership for digital citizenship.~~

T6 — Technology Operations and Concepts

~~Students demonstrate a sound understanding of technology concepts, systems, and operations. Students do the following:~~

- a. — ~~Understand and use technology systems.~~
- b. — ~~Select and use applications effectively and productively.~~
- c. — ~~Troubleshoot systems and applications.~~
- d. — ~~Transfer current knowledge to learning of new technologies.~~